P2219, 1904

[illegible]

ROSS' CELEBRATED LENSES

AND ENEW AND MIRROR ANASTIGMATS,
AN ABSOLUTELY UNEQUALLED SELECTION
FOR EVERY DEPARTMENT OF PHOTOGRAPHY.

1904.

[illegible]

ROSS'

PATENT 'HOMOCENTRIC' LENSES.

AN UNRIVALLED NEW SERIES.

See pages 35 to 60.

ROSS' CELEBRATED LENSES

And ZEISS' AND GOERZ' ANASTIGMATS.

AN ABSOLUTELY UNEQUALLED SELECTION
FOR EVERY DEPARTMENT OF PHOTOGRAPHY.

Index to Contents, pages 1183 to 1190.
Index to Advertisements, pages 1255 to 1262.

1904.

JANUARY.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	...	...	...	...	...	...

FEBRUARY.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	...	...	...	...	...

MARCH.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...

APRIL.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

MAY.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...

JUNE.

S	M	T	W	T	F	S
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	...	...

JULY.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	...	...	...	...	...	...

AUGUST.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...

SEPTEMBER.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	...

OCTOBER.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	...	...	...	...	...

NOVEMBER.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	...	...	...

DECEMBER.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

POSTAL AND TELEGRAPHIC ADDRESSES,
1267 to 1277.

ROSS'

PATENT 'HOMOCENTRIC' LENSES.

AN UNRIVALLED NEW SERIES.

See pages 35 to 98.

'77 WRATTEN'S 'LONDON' PLATES '04
STAND THE TEST
OF TIME.

JANUARY.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H.	M.	Sets. H.	M.	MOON. Rises. After.		Sets. Morn.	
1	F		8	8	3	59	2	54	5	36
2	S		8	8	4	0	3	52	6	42
3	S	2nd Sunday after Christmas ○ 5.47 M.	8	7	4	1	4	59	7	41
4	M		8	7	4	3	6	14	8	31
5	Tu		8	7	4	4	7	33	9	12
6	W	Epiphany	8	7	4	5	8	52	9	48
7	Th	Daguerreotype com. to Acad. of Sc.	8	6	4	6	10	11	10	19
8	F	[(Paris), 1839	8	6	4	7	11	27	10	47
9	S	☾ 9.10 A.	8	5	4	8	Morn		11	15
10	S	1st Sunday after Epiphany	8	5	4	9	0	40	11	43
11	M		8	5	4	11	1	50	0	12
12	Tu		8	4	4	12	2	57	0	45
13	W	William Bedford d. 1893	8	4	4	14	4	2	1	22
14	Th		8	3	4	15	5	3	2	3
15	F	G. W. Simpson d. 1880	8	2	4	16	5	56	2	50
16	S		8	2	4	18	6	43	3	42
17	S	2nd Sunday after Epiphany ● 3.47 A.	8	1	4	20	7	24	4	38
18	M	E. Lacan d. 1879. Rejlander d. 1875.	7	59	4	21	8	0	5	37
19	Tu		7	58	4	23	8	30	6	38
20	W	Photo. Soc. of Lon. f. 1853	7	57	4	25	8	57	7	39
21	Th	Fox Talbot b. 1800	7	56	4	26	9	22	8	41
22	F	Sir W. Newton d. 1869	7	55	4	28	9	45	9	44
23	S		7	54	4	30	10	8	10	48
24	S	3rd Sunday after Epiphany	7	52	4	32	10	31	11	54
25	M	☽ 8.41 A.	7	51	4	33	10	57	Morn	
26	Tu		7	50	4	35	11	27	1	0
27	W	[Willème, 1863	7	49	4	37	0	1	2	7
28	Th	Photo-sculpture pat. by	7	47	4	39	0	42	3	14
29	F	[Royal Soc. 1839	7	46	4	40	1	32	4	19
30	S	Fox Talbot's first communication to	7	44	4	42	2	33	5	20
31	S	Septuagesima Sunday	7	43	4	44	3	45	6	16

RESIDUES
Reduce
every description
of
PHOTOGRAPHIC
RESIDUES.
CONSIGNMENTS AND
REMITTANCES
PUNCTUALLY
ATTENDED TO.
J., J. J. & T. G. BLUNDELL, Gold, Silver, & Platinum Refiners & Dealers,
199 (formerly 162), WARDOUR STREET, LONDON, W.

WRATTEN'S
'LONDON' PLATES.
KNOWN THROUGHOUT THE WORLD AS UNEQUALLED FOR EASE OF WORKING AND EXCELLENCE OF RESULTS.

FEBRUARY.

D. M.	D. W.	Remarkable Events.	SUN.		MOON.	
			Rises. H. M.	Sets. H. M.	Rises. After.	Sets. Morn.
1	M	○ 4.33 A.	7 42	4 46	5 2	7 3
2	Tu		7 40	4 48	6 23	7 43
3	W		7 39	4 49	7 45	8 18
4	Th		7 37	4 51	9 5	8 48
5	F		7 35	4 53	10 22	9 17
6	S		7 33	4 55	11 36	9 46
7	S	Sexagesima Sunday	7 32	4 56	Morn	10 17
8	M	Calotype Process pat. 1841 ☾ 9.56 M.	7 31	4 57	0 47	10 49
9	Tu		7 29	4 59	1 54	11 24
10	W	Sir David Brewster d. 1868	7 27	5 1	2 56	0 3
11	Th		7 25	5 3	3 52	0 47
12	F		7 23	5 5	4 41	1 38
13	S	Leon Foucault d. 1868	7 21	5 7	5 24	2 33
14	S	Quinquagesima Sunday	7 19	5 9	6 1	3 31
15	M		7 17	5 11	6 32	4 30
16	Tu	● 11.5 M.	7 15	5 13	7 1	5 32
17	W	[portraiture) pat. 1857	7 13	5 15	7 27	6 34
18	Th	Moule's Photogen (artificial light for	7 11	5 17	7 51	7 37
19	F	[1855	7 10	5 18	8 14	8 40
20	S	Poitevin's p. of Helioplastie pub.	7 8	5 20	8 37	9 44
21	S	1st Sunday in Lent	7 6	5 22	9 2	10 48
22	M		7 4	5 24	9 29	11 53
23	Tu		7 2	5 26	10 0	Morn
24	W	☽ 11.9 M.	7 0	5 28	10 38	0 59
25	Th		6 57	5 29	11 23	2 3
26	F	Senefelder d. 1834. Padre Secchi d.	6 55	5 31	0 16	3 4
27	S	[1876. Arago b. 1786	6 53	5 33	1 19	4 0
28	S	2nd Sunday in Lent	6 51	5 35	2 31	4 50
29	M		6 50	5 36	3 50	5 33

RESIDUES
Nitrate of Silver
Chloride of Gold &
(best quality only)
MELTING and
ASSAYING
done for the trade.
J., J. J. & T. G. BLUNDELL, Gold, Silver, & Platinum Refiners & Dealers,
199 (formerly 162), WARDOUR STREET, LONDON, W.

WRATTEN'S
'LONDON' PLATES.
MADE IN ALL SIZES TO SUIT
EVERY PURPOSE AND CAMERA.

MARCH.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	Tu		6 49	5 37	5 11	6 10
2	W	○ 2.48 M.	6 47	5 38	6 33	6 43
3	Th		6 45	5 39	7 54	7 14
4	F	Poitevin d. 1882	6 43	5 41	9 13	7 44
5	S	La Place d. 1827. J. Albert b. 1825	6 41	5 43	10 28	8 15
6	S	3rd Sunday in Lent	6 39	5 45	11 40	8 47
7	M	J.N.Niepce b.1765. Herschel b.1792	6 36	5 46	Morn	9 22
8	Tu		6 34	5 48	0 45	10 1
9	W	G. W. Wilson d. 1893 ☾ 1.1 M.	6 32	5 50	1 44	10 44
10	Th		6 30	5 52	2 36	11 33
11	F	St. Claire Deville b. 1818	6 27	5 54	3 22	0 27
12	S		6 24	5 56	4 1	1 24
13	S	4th Sunday in Lent	6 22	5 58	4 35	2 23
14	M	Herschel int. hypo for fixing, 1839	6 20	6 0	5 3	3 24
15	Tu		6 17	6 1	5 30	4 26
16	W		6 15	6 3	5 55	5 29
17	Th	● 5.39 M.	6 13	6 5	6 18	6 32
18	F		6 11	6 6	6 42	7 36
19	S	Thomas Sutton d. 1875	6 9	6 7	7 7	8 41
20	S	5th Sunday in Lent	6 7	6 9	7 33	9 46
21	M		6 5	6 11	8 3	10 51
22	Tu		6 2	6 12	8 38	11 55
23	W		6 0	6 14	9 19	Morn
24	Th	Becquerel b. 1820 ☽ 9.37 A.	5 58	6 16	10 8	0 56
25	F	Hermagis d 1863	5 55	6 17	11 7	1 52
26	S		5 53	6 19	0 13	2 42
27	S	Palm Sunday	5 51	6 21	1 25	3 27
28	M	La Place b. 1749	5 48	6 22	2 43	4 5
29	Tu		5 46	6 24	4 3	4 39
30	W		5 44	6 26	5 23	5 10
31	Th	○ 0.41 A.	5 42	6 28	6 43	5 40

RESIDUES
COMPLETE
RECOVERY
of
GOLD, SILVER,
AND PLATINUM
guaranteed, and
Full Market Value
allowed.
J., J. J. & T. C. BLUNDELL, Gold and Silver Refiners and Melters,
199 (formerly 162), WARDOUR STREET, LONDON, W.

WRATTEN'S

'LONDON' PLATES

ARE ESSENTIAL FOR WORK UNDER DIFFICULT CLIMATIC CONDITIONS.

APRIL.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	F	[cault, 1815. Morse d. 1872	5 39	6 29	8 1	6 10
2	S	First Sun Pho. by Fizeau and Fou-	5 37	6 31	9 16	6 42
3	S	Easter Sunday	5 35	6 33	10 27	7 16
4	M		5 33	6 34	11 31	7 55
5	Tu	Rev. J. B. Reade b. 1801	5 31	6 36	Morn	8 38
6	W		5 28	6 38	0 28	9 26
7	Th	Voigländer d. 1878. ☾ 5.53 A.	5 26	6 39	1 17	10 19
8	F	[1839	5 24	6 40	1 59	11 15
9	S	Fox Talbot's First Art. in *Athenæum*,	5 22	6 42	2 36	0 14
10	S	Low Sunday	5 20	6 44	3 7	1 15
11	M		5 17	6 45	3 34	2 16
12	Tu		5 15	6 47	3 59	3 18
13	W		5 13	6 49	4 23	4 21
14	Th		5 11	6 51	4 46	5 26
15	F	● 9.53 A.	5 8	6 52	5 10	6 31
16	S		5 6	6 54	5 36	7 37
17	S	2nd Sunday after Easter	5 4	6 56	6 5	8 43
18	M		5 2	6 58	6 39	9 48
19	Tu	Warren de la Rue d. 1889	5 0	6 59	7 18	10 51
20	W		4 53	7 0	8 4	11 49
21	Th	Talbot's Photo.-etch. Proc. pat. 1858	4 56	7 2	8 59	Morn
22	F		4 54	7 4	10 3	0 41
23	S	☽ 4.55 M.	4 51	7 5	11 12	1 25
24	S	3rd Sunday after Easter	4 49	7 7	0 25	2 4
25	M	"Sun-blinds" pat. 1862	4 47	7 8	1 41	2 39
26	Tu	Adam Salomon d. 1881	4 46	7 10	2 59	3 9
27	W		4 44	7 12	4 17	3 38
28	Th	M. Carey Lea d. 1897	4 42	7 14	5 35	4 7
29	F	○ 10.36 A.	4 39	7 15	6 51	4 37
30	S	Colonel Stuart Wortley d. 1890	4 37	7 17	8 5	5 10

J. LANCASTER & SON, Birmingham.

ABRIDGED CATALOGUE PAGES 479-542

Nearly 340,000 Cameras Sold Over 500,000 Lenses Sold
For New Cameras see pages 479-507
For Lenses see pages 508-512
For Roll Film Cameras see pages 500-502
For Midget Cameras see pages 522 523
For New Pattern Rubralux see page 517
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WRATTEN'S

'LONDON' PLATES

Are ordered by the leading Governments, Universities and Observatories for all Work in the tropics and Laboratory Precision Work at home.

MAY.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	S	4th Sunday after Easter	4 35	7 19	9 14	5 46
2	M		4 33	7 21	10 16	6 28
3	Tu		4 32	7 22	11 9	7 15
4	W	Senebier b. 1742	4 30	7 24	11 56	8 6
5	Th	J. W. Draper b. 1811	4 28	7 26	Morn	9 1
6	F	Humboldt d. 1859	4 26	7 27	0 35	10 0
7	S	☾ 11.50 M.	4 25	7 28	1 8	11 1
8	S	Rogation Sunday. P. Meagher d.	4 23	7 29	1 36	0 3
9	M	[1897	4 21	7 30	2 2	1 5
10	Tu		4 20	7 32	2 26	2 7
11	W	Becquerel d. 1891	4 18	7 34	2 49	3 11
12	Th	Ascension Day. W. B. Bolton d.	4 16	7 36	3 13	4 16
13	F	J. v. Liebig b. 1803 [1899	4 14	7 38	3 38	5 23
14	S	Fahrenheit b. 1686	4 13	7 39	4 6	6 31
15	S	Sun. aft. Ascen. ● 10.58 M.	4 11	7 41	4 38	7 38
16	M	Major C. Russell d. 1887	4 10	7 42	5 15	8 43
17	Tu	Association Belge founded, 1874	4 8	7 44	5 59	9 45
18	W		4 7	7 45	6 53	10 39
19	Th		4 5	7 47	7 54	11 27
20	F		4 4	7 48	9 1	Morn
21	S	Scheele d. 1786	4 3	7 49	10 14	0 7
22	S	Whit Sunday ☽ 10.19 M.	4 2	7 50	11 30	0 42
23	M	B. J. Sayce d. 1895	4 1	7 52	0 46	1 14
24	Tu		4 0	7 54	2 1	1 43
25	W		3 58	7 56	3 17	2 11
26	Th		3 57	7 57	4 32	2 39
27	F		3 56	7 58	5 46	3 9
28	S		3 55	7 59	6 56	3 43
29	S	Trinity Sunday. ○ 8.55 M.	3 54	8 0	8 1	4 21
30	M		3 53	8 1	8 59	5 4
31	Tu		3 52	8 2	9 50	5 54

J. LANCASTER & SON, Birmingham.

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WRATTEN'S

'LONDON' PLATES

Are made in several rapidities, each distinct and carefully adjusted for its special use.

JUNE.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	W		3 51	8 3	10 32	6 48
2	Th	Niepce pub. his "Heliochromic Pro-	3 50	8 5	11 9	7 46
3	F	[cesses," 1851	3 50	8 6	11 40	8 47
4	S	Tessié du Mothay d. 1880	3 49	8 7	Morn	9 49
5	S	1st Sun. aft. Trinity.	3 48	8 8	0 6	10 51
6	M	☾ 5.53 M.	3 47	8 9	0 30	11 53
7	Tu	Fraunhofer d. 1826	3 46	8 10	0 53	0 56
8	W		3 46	8 12	1 16	2 0
9	Th	Alvan Clark d. 1897	3 46	8 12	1 41	3 6
10	F	[1853	3 46	8 13	2 7	4 13
11	S	Cutting's American Bromide pat.	3 45	8 13	2 36	5 20
12	S	2nd Sun. aft. Trin.	3 45	8 14	3 10	6 27
13	M	● 9.11 A.	3 45	8 15	3 52	7 32
14	Tu	Partnership between Daguerre and	3 45	8 15	4 43	8 32
15	W	[Niepce, 1837	3 44	8 16	5 41	9 24
16	Th	Chrysotype and Cyanotype Pro.	3 44	8 16	6 48	10 8
17	F	[com. to Royal Soc., 1842	3 44	8 16	8 2	10 45
18	S		3 44	8 17	9 17	11 18
19	S	3rd Sun. aft. Trin.	3 44	8 18	10 33	11 48
20	M	☽ 3.11 A.	3 44	8 18	11 50	Morn
21	Tu	Niepce Memorial uncov. at Chalons,	3 44	8 18	1 6	0 16
22	W	[1885	3 44	8 18	2 20	0 44
23	Th		3 45	8 19	3 33	1 13
24	F	Hardwich d. 1890	3 45	8 19	4 43	1 44
25	S	[b. 1839	3 45	8 19	5 49	2 19
26	S	4th Sun. aft. Trin. Liesegang	3 45	8 19	6 49	2 59
27	M	Herr Wothly d. 1873. ○ 8.23 A.	3 46	8 19	7 43	3 46
28	Tu		3 47	8 19	8 28	4 38
29	W	Ferrous-oxalate Developer pub. 1877	3 47	8 19	9 7	5 34
30	Th		3 48	8 19	9 41	6 33

J. LANCASTER & SON, Birmingham.

ABRIDGED CATALOGUE PAGES 479-542

Nearly 340,000 Cameras Sold Over 500,000 Lenses Sold
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For Lenses see pages 508-512
For Roll Film Cameras see pages 500-502
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WRATTEN'S

'LONDON' PLATES.

Ordinary (green label), a slow landscape plate giving great brilliancy and sparkle, unequalled for all work permitting the necessary exposure.

JULY.

D. M.	D. W.	REMARKABLE EVENTS.	SUN.		MOON.	
			Rises. H. M.	Sets. H. M.	Rises. After.	Sets. Morn.
1	F		3 48	8 18	10 10	7 35
2	S		3 49	8 18	10 35	8 38
3	S	5th Sun. aft. Trin.	3 50	8 18	10 58	9 41
4	M		3 50	8 18	11 21	10 43
5	Tu	Nicephore Niepce d. 1833 ☾ 10.54 A.	3 51	8 17	11 44	11 45
6	W	W. J. Stillman d. 1901, aged 74	3 51	8 17	Morn	0 49
7	Th		3 52	8 16	0 8	1 54
8	F		3 53	8 16	0 35	3 0
9	S	[1851	3 54	8 15	1 6	4 7
10	S	6th Sun. after Trin. Daguerre d.	3 55	8 14	1 43	5 13
11	M	[1897	3 57	8 13	2 29	6 16
12	Tu	Wedgwood b. 1730, G. Dawson d.	3 57	8 12	3 25	7 13
13	W	Abbé Moigno d. 1884 ● 5.27 M.	3 58	8 11	4 29	8 2
14	Th	Dumas b. 1800	3 59	8 10	5 41	8 44
15	F		4 1	8 9	6 59	9 20
16	S	Claudet b. 1797	4 3	8 8	8 18	9 51
17	S	7th Sun. aft. Trin. [1872	4 4	8 7	9 37	10 20
18	M	V. M. Griswold (Inv. Ferrotype) d	4 5	8 6	10 54	10 49
19	Tu	☽ 8.49 A.	4 6	8 5	0 10	11 18
20	W	Collodion Pos. Process pub. 1852	4 7	8 4	1 23	11 49
21	Th	Regnault b. 1810	4 8	8 2	2 33	Morn
22	F		4 10	8 1	3 40	0 22
23	S	[Abney b. 1843	4 11	8 0	4 43	0 59
24	S	8th Sun. aft Trin. Sir William	4 12		5 38	1 43
25	M		4 14	7 58	6 26	2 32
26	Tu	Niepce de St. Victor b. 1806	4 15	7 57	7 7	3 26
27	W	○ 9.42 M.	4 17	7 55	7 43	4 24
28	Th		4 18	7 54	8 12	5 25
29	F	Secchi b. 1818	4 19	7 53	8 39	6 27
30	S		4 21	7 51	9 4	7 29
31	S	9th Sun. aft. Trin. Wohler b. 1800	4 22	7 50	9 27	8 31

J. LANCASTER & SON, Birmingham.

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WRATTEN'S
'LONDON' PLATES.

Instantaneous (yellow label), our Standard Plate. Of medium rapidity it is without equal for all work up to slow shutter exposures inland.

AUGUST.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	M		4 23	7 49	9 49	9 34
2	Tu		4 25	7 47	10 12	10 37
3	W	Mungo Ponton d. 1880	4 26	7 46	10 38	11 40
4	Th	☾ 2.3 A.	4 28	7 44	11 6	0 44
5	F	Wollaston b. 1766. W. K. Burton	4 31	7 41	11 39	1 50
6	S	[d. 1899	4 32	7 40	Morn	2 55
7	S	10th Sun. aft. Trin. Berzelius d.	4 33	7 39	0 19	3 57
8	M	Roger Fenton d. 1869 [1848	4 35	7 37	1 8	4 56
9	Tu		4 36	7 35	2 8	5 49
10	W	W. H. Harrison d. 1897	4 37	7 33	3 15	6 36
11	Th	● 0.53 A.	4 38	7 32	4 31	7 14
12	F		4 40	7 30	5 51	7 49
13	S	Prof. Stokes b. 1819	4 42	7 28	7 13	8 21
14	S	11th Sun. aft. Trin.	4 44	7 26	8 34	8 51
15	M		4 46	7 24	9 53	9 20
16	Tu	Lavoisier b. 1743	4 47	7 21	11 10	9 51
17	W	[microscopist) d. 1884	4 49	7 19	0 23	10 24
18	Th	Dr. Woodward (photo- ☽ 4.27 M.	4 51	7 17	1 33	11 0
19	F		4 52	7 15	2 36	11 43
20	S	[1786	4 53	7 13	3 33	Morn
21	S	12th Sun. after Trin. Chevreul b.	4 55	7 11	4 24	0 30
22	M		4 56	7 10	5 7	1 22
23	Tu	[1867	4 58	7 8	5 43	2 19
24	W	Cutting (Introd. of Ambrotype) d	5 0	7 6	6 15	3 18
25	Th	Faraday d. 1867	5 1	7 3	6 43	4 18
26	F	Daguerre Mem. uncov. 1883. ○ 1.2 M.	5 3	7 1	7 8	5 20
27	S		5 5	6 59	7 31	6 22
28	S	13th Sun. aft. Trin.	5 6	6 56	7 54	7 25
29	M		5 8	6 54	8 17	8 28
30	Tu	Oliver Sarony, 1879	5 9	6 53	8 42	9 31
31	W	Helmholtz b. 1821	5 11	6 51	9 9	10 34

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SEPTEMBER.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	Th	Norris's Dry-plate Process pat. 1856	5 12	6 48	9 39	11 38
2	F		5 14	6 46	10 15	0a41
3	S	☾ 2.59 M.	5 16	6 43	10 59	1 42
4	S	14th Sun. aft. Trin.	5 17	6 41	11 52	2 41
5	M	Pantascopic Camera patented, 1862	5 19	6 39	Morn	3 36
6	Tu		5 21	6 37	0 54	4 25
7	W	Poitevin Mem. inaug., 1885	5 22	6 34	2 4	5 8
8	Th	Gel.-bro. Proc. pub. by Maddox, 1871	5 24	6 32	3 21	5 47
9	F	Col.-bro. Proc. pub. 1864 ● 8.43 A.	5 26	6 30	4 42	6 20
10	S		5 27	6 27	6 4	6 49
11	S	15th Sun. aft. Trin.	5 29	6 25	7 26	7 18
12	M		5 30	6 23	8 46	7 49
13	Tu		5 31	6 21	10 4	8 22
14	W	Humboldt b. 1769	5 33	6 19	11 18	8 59
15	Th	Petzval d. 1891	5 35	6 17	0a26	9 40
16	F	☽ 3.13 A.	5 36	6 14	1 27	10 26
17	S	Fox Talbot d. 1877	5 38	6 12	2 20	11 17
18	S	16th Sun. aft. Trin. Leon Foucault	5 39	6 9	3 6	Morn
19	M	T. Grubb d. 1878 [b. 1819	5 41	6 7	3 44	0 12
20	Tu	Talbot's Disc. of Develop. 1840	5 43	6 5	4 17	1 10
21	W	Stas b. 1813	5 44	6 2	4 46	2 11
22	Th	Faraday b. 1791. Thos. Sutton b.	5 45	6 0	5 12	3 13
23	F	Woodbury Pro. pat. 1864 [1819	5 47	5 58	5 37	4 15
24	S	○ 5.50 A.	5 49	5 55	6 0	5 18
25	S	17th Sun. aft. Trin. Dr. Van Monck-	5 51	5 53	6 22	6 21
26	M	[hoven b. 1834, d. 1882	5 53	5 51	6 46	7 24
27	Tu	Kolbe b. 1818	5 54	5 48	7 12	8 27
28	W		5 55	5 47	7 42	9 30
29	Th		5 57	5 45	8 16	10 33
30	F	Balard (Discoverer of Bromine) b. [1802	5 58	5 42	8 55	11 35

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OCTOBER.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	S		6 0	5 40	9 43	0 34
2	S	18th Sun. aft. Trin. ☾ 1.52 A.	6 2	5 38	10 40	1 28
3	M		6 3	5 35	11 45	2 17
4	Tu		6 5	5 33	Morn	3 1
5	W		6 7	5 31	0 55	3 39
6	Th		6 9	5 28	2 12	4 12
7	F	Leon Warnerke d. 1900	6 11	5 26	3 32	4 44
8	S		6 12	5 24	4 54	5 15
9	S	19th Sun. aft. Trin. ● 5.25 M.	6 14	5 21	6 16	5 45
10	M		6 16	5 19	7 36	6 17
11	Tu		6 18	5 17	8 54	6 53
12	W	Gmelin b. 1792	6 20	5 14	10 8	7 33
13	Th		6 21	5 12	11 14	8 18
14	F		6 22	5 10	0a13	9 8
15	S		6 24	5 8	1 3	10 3
16	S	20th Sun. aft. Trin. ☽ 5.54 M. [1887	6 26	5 6	1 44	11 1
17	M	Reaumur d. 1757. Robert Hunt d.	6 27	5 4	2 20	Morn
18	Tu	Schonbein b. 1799. Wheatstone d.	6 29	5 1	2 50	0 2
19	W	[1875	6 30	4 59	3 17	1 3
20	Th		6 32	4 58	3 41	2 5
21	F		6 34	4 56	4 4	3 7
22	S		6 36	4 54	4 27	4 10
23	S	21st Sun. aft. Trin.	6 38	4 52	4 51	5 13
24	M	○ 10.56 M.	6 39	4 49	5 16	6 17
25	Tu	Vernon Heath d. 1895	6 41	4 47	5 43	7 22
26	W		6 43	4 45	6 16	8 26
27	Th		6 45	4 43	6 55	9 29
28	F	Col.-chlo. of Silver Process pub. 1864	6 46	4 42	7 40	10 30
29	S	Talbot Photo-eng. Process pat. 1852	6 48	4 40	8 33	11 26
30	S	22nd Sun. aft. Trin.	6 50	4 38	9 33	0a16
31	M	☾ 11.13 M.	6 52	4 36	10 41	1 0

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NOVEMBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After	MOON. Sets. After.
1	Tu		6 54	4 34	11 54	1 38
2	W		6 56	4 32	Morn	2 12
3	Th		6 58	4 30	1 10	2 43
4	F		7 0	4 28	2 28	3 12
5	S	[1771	7 1	4 27	3 47	3 41
6	S	23rd Sun. aft. Trin. Senefelder b.	7 3	4 25	5 7	4 12
7	M	Dubois Raymond b. 1818 ● 3.37 A.	7 4	4 24	6 26	4 45
8	Tu	J. T. Taylor d. 1895	7 6	4 22	7 42	5 22
9	W	Pretsch's Pho.-eng. Pro. pat. 1854	7 8	4 20	8 51	6 5
10	Th	Laroche d. 1886	7 9	4 19	10 0	6 55
11	F	Willis's Aniline Process pat. 1864	7 11	4 17	10 54	7 49
12	S		7 13	4 15	11 41	8 48
13	S	4th Sun. aft. Trin.	7 14	4 14	0 19	9 49
14	M		7 16	4 12	0 52	10 51
15	Tu	☽ 0.33 M.	7 18	4 11	1 20	11 53
16	W	Lavater d. 1741	7 20	4 10	1 45	Morn
17	Th		7 22	4 8	2 8	0 56
18	F	Daguerre b. 1787	7 23	4 7	2 31	1 59
19	S		7 25	4 6	2 54	3 2
20	S	25th Sun. aft. Trin. Prof. Draper	7 27	4 5	3 19	4 6
21	M	[d. 1882	7 28	4 4	3 46	5 10
22	Tu	Schlippe b. 1749	7 30	4 2	4 17	6 15
23	W	Harrison (Inv. of Globe ○ 3.12 M.	7 31	4 1	4 53	7 20
24	Th	[Lens) d. 1864	7 33	4 1	5 36	8 23
25	F		7 35	3 58	6 27	9 22
26	S		7 36	3 58	7 26	10 16
27	S	1st Sun. in Advent. Celsius b. 1701	7 38	3 56	8 32	11 2
28	M	Sutton Panoramic Camera pat. 1859	7 40	3 56	9 42	11 41
29	Tu		7 41	3 55	10 57	0 16
30	W	☾ 7.38 M.	7 42	3 54	Morn	0 47

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DECEMBER.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. Morn.	MOON. Sets. After.
1	Th	Klaproth b. 1743	7 44	3 54	0 13	1 16
2	F		7 45	3 53	1 29	1 43
3	S	[1896	7 47	3 53	2 46	2 11
4	S	2nd Sun. in Advent R. Kennet d.	7 48	3 52	4 3	2 42
5	M		7 49	3 51	5 19	3 16
6	Tu	Obernetter's chromo-photo pat. 1864	7 50	3 51	6 32	3 56
7	W	● 3.46 M.	7 51	3 51	7 41	4 42
8	Th		7 52	3 51	8 42	5 34
9	F	Scheele b. 1742. Duc de Luynes d.	7 53	3 50	9 34	6 31
10	S	[1867	7 54	3 50	10 17	7 32
11	S	3rd Sun. in Advent Sir D. Brewster	7 56	3 50	10 53	8 35
12	M	Rev. J. B. Reade d. 1870 [b. 1781	7 57	3 49	11 23	9 38
13	Tu	First Photo enam. Proc. pat. 1854	7 58	3 49	11 49	10 41
14	W	☽ 10.7 A.	7 59	3 49	0 13	11 44
15	Th		8 0	3 49	0 36	Morn
16	F	H. Greenwood d. 1884. T. Ross d.	8 1	3 49	0 58	0 46
17	S	Sir Humphry Davy b. 1778 [1870	8 2	3 49	1 21	1 49
18	S	4th Sun. in Advent	8 3	3 49	1 46	2 53
19	M	Dr. H. W. Vogel d. 1898	8 4	3 50	2 15	3 58
20	Tu		8 4	3 50	2 49	5 4
21	W		8 5	3 51	3 29	6 9
22	Th	Wollaston d. 1828 ○ 6.1 A.	8 5	3 51	4 17	7 11
23	F		8 6	3 52	5 15	8 8
24	S		8 6	3 52	6 20	8 58
25	S	Christmas Day. Sir I. Newton b.	8 7	3 53	7 31	9 42
26	M	[1642	8 7	3 53	8 45	10 20
27	Tu		8 7	3 54	10 1	10 52
28	W	J. T. Goddard d. 1866	8 7	3 55	11 18	11 21
29	Th	☾ 3.46 A.	8 8	3 56	Morn	11 49
30	F	J. H. Dallmeyer d. 1883	8 8	3 57	0 34	0 17
31	S	A. Braun d. 1877	8 8	3 58	1 50	0 46

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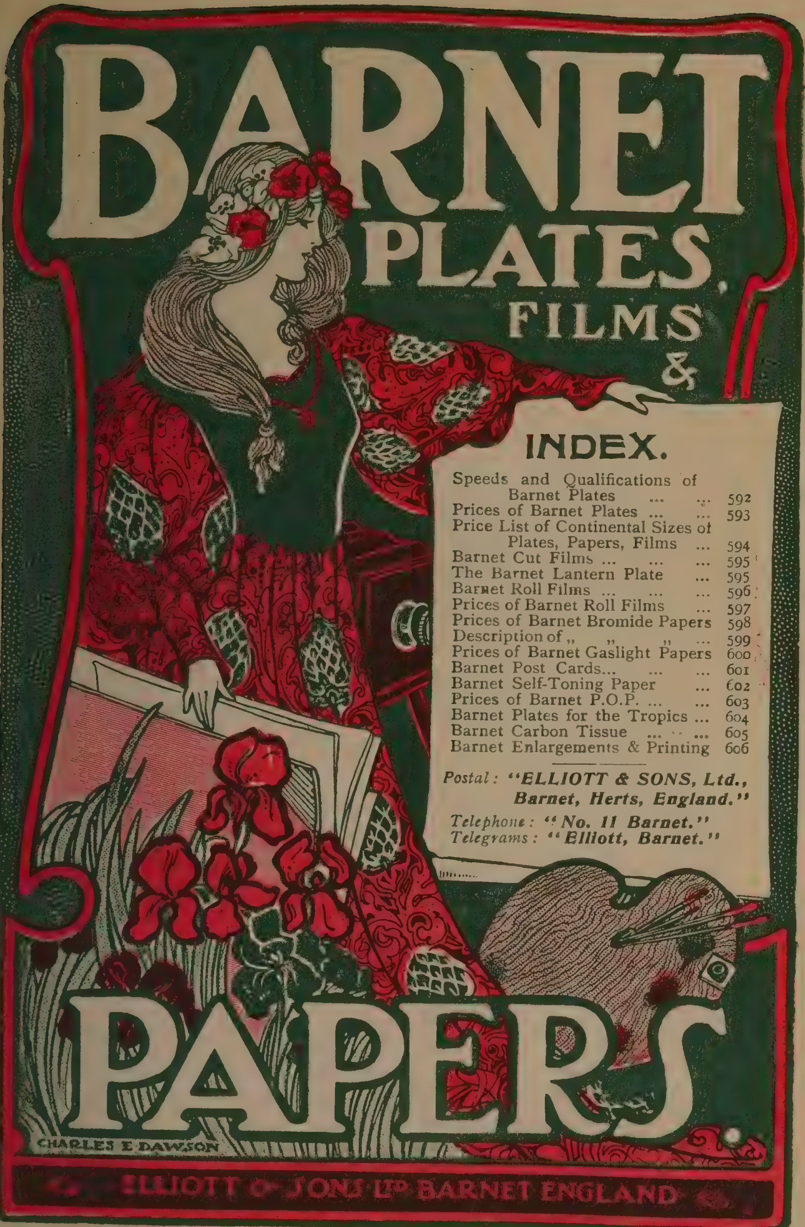

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5 ,, 4	1/7	2/6	-/4
6½ ,, 4¼	2/2	3/3	-/6
6½ ,, 4¾	2/3	3/8	-/6
7¼ ,, 4½	2/10	4/6	-/6
7½ ,, 5	3/5	5/3	-/9
8½ ,, 6½	4/3	6/6	-/9
9 ,, 7	5/0	8/0	-/9
10 ,, 8	7/3	10/6	1/0
13 ,, 8	10/0	15/0	1/3
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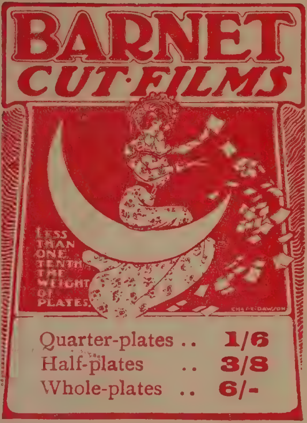
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2½ in. ..	2½ ,, 4¼ ..	..	
3¼ in. ..	3¼ ,, 4¼ ..	..	
3½ in. ..	3½ ,, 3½ ..	..	
4 in. ..	4 ,, 5 ..	..	
4¼ in. ..	4¼ ,, 3¼ ..	..	
5 in. ..	5 ,, 4 ..	..	
7 in. ..	7 ,, 5 ..	..	

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7½ ,, 5 ...	—		...	1	3	
8½ ,, 6½ ...	—		...	2	0	
10 ,, 8 ...	—		...	2	9	in Tube or Packet.
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12½ ,, 10½ ...	2	4	...	4	6	
15 ,, 12 ...	3	3	...	6	3	
15½ ,, 12½ ...	3	6	...	6	9	
18 ,, 15 ...	5	0	...	9	6	
23 ,, 17 ...	6	9	...	12	6	
25 ,, 21 ...	9	6	...	18	0	
30 ,, 25 ...	13	6	...	26	0	

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4¼ × 3¼	12 ,,	0	6				
5 × 4	12 ,,	0	9				
6 × 4¼	12 ,,	0	10				
6½ × 4¾	12 ,,	1	0				
7½ × 5	12 ,,	1	3				
8 × 6	12 ,,	1	9				
8½ × 6½	12 ,,	2	0				
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3¼ × 3¼	...	16 ,,	...	0	6
3½ × 3½	...	14 ,,	...	0	6
4¼ × 3¼	...	12 ,,	...	0	6
4¼ × 3¼	...	28 ,,	...	1	0
5 × 4	...	19 ,,	...	1	0
6 × 4¼	...	15 ,,	...	1	0
6½ × 4¾	...	12 ,,	...	1	0
7 × 5	...	11 ,,	...	1	0
7½ × 5	...	10 ,,	...	1	0
8½ × 6½	...	7 ,,	...	1	0
10 × 8	...	4 ,,	...	1	0
12 × 10	...	6 ,,	...	2	0

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3¼	,,	3¼	...	20 ,,	-/6 ...	47	,,	1/0
3½	,,	3½	...	18 ,,	-/6 ...	40	,,	1/0
4	,,	3	...	18 ,,	-/6 ...	42	,,	1/0
4¼	,,	3¼	...	16 ,,	-/6 ...	36	,,	1/0
5	,,	4	...	10 ,,	-/6 ...	24	,,	1/0
6	,,	4¼	...	...	... ...	24	,,	1/0
6½	,,	4¾	...	...	... ...	16	,,	1/0
7½	,,	5	...	...	... ...	12	,,	1/0
8½	,,	6½	...	...	... ...	9	,,	1/0
10	,,	8	...	...	... ...	12	,,	2/0
12	,,	10	...	...	... ...	12	,,	3/0

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Thin	0/3	0/4	0/5	0/10	1/4	2/0	2/8	3/6	..	..
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Medium	0/3	0/4	0/5	0/9	1/2	1/9	2/6	3/0	..	..
Thin	0/3	0/4	0/6	0/10	1/4	2/0	3/0	3/6	..	..
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Hillsbro' (Sheffield) and District Photographic Society.—(ESTABLISHED 1902.)—Meetings held at Makin's School, Beechwood Road, Hillsbro'. *President*—Geo. Neale. *Vice-Presidents*—J. W. Wright, E. Peace, W. Hopkinson. *Committee*—Messrs. Turner, A. Drake, P. Dukinfield, G. Glover, W. Oates, W. Bland. *Treasurer*—H. Huntley. *Secretary*—W. T. Furniss, 256 Langsett Road, Sheffield. *Assistant Secre-tary*—B. Glossop.

Holmfirth Photographic Society.—(Federated with the Yorkshire Photographic Union).—(ESTABLISHED 1901.)—Meetings held at Holmfirth Technical Institute. *President*—Dr. Williams. *Vice-Presidents*—Miss Burtt, Captain Jessop, Dr. Watthews, Messrs. J. T. Taylor, J.P., A. H. Wood, F. Greenwood, J. E. Woodhead, Heastie. *Committee*—Mrs. Copley, H. Crossley, J. F. Copley, J. R. Hogley, F. Bamforth. *Hon. Lanternist*—Frank Bamforth. *Hon. Treasurer*—Wm. Brown. *Hon. Secretary*—Geo. Holdsworth, Dean Bridge, Holmfirth.

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Page 506. **"The Invincible."**
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Jersey Photographic Society.—(Established 1901, Re-Formed 1902).—Meetings held at the Beresford Café, Beresford Street Jersey. *President*—Dr. A. C. Stamberg. *Vice-President*—Mr. C. R. Poingdestre. *Committee*—Messrs. Day, Cocks, Terry, and Miss Bentley. *Treasurer and Secretary*—Mr. Rodney Porter, 21 Chevalier Road, Jersey.

Keighley and District Photographic Association.—(Federated with the Yorkshire Photographic Union).—(Established 1888.)—Meetings held at the Mechanics' Institute. *President*—F. Mahony. *Vice-Presidents*—J. G. Dickinson, T. Heaps, A. Keighley, F.R.P.S., W. Robertshaw. W. Tate. *Committee*—John Cockshott, Luther Firth, J. Gill, M. Houghton, W. Mitchell, E. Myers, T. A. Smith, J. Wilkinson. *Lanternists*—W. H. Hainsworth, Norman Barrett. *Librarian*—F. Gill. *Treasurer*—B. P. Heaton. *Secretaries*—C. H. Smith, 110 Devonshire Street, and H. E. Haggas, 33 Devonshire Street, Keighley.

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Leeds Camera Club.—(ESTABLISHED 1893.)—Meetings held at the Athenæum, 9 Park Lane. *President*—Charles B. Howdill, A.R.I.B.A. *Vice-Presidents*—Rev. T. Arthur Curties, W. Emmott, A. Homburg, F. Rust (E. A. Heywood, deceased). *Council*—A. D. Berry, F. E. Clarke, J. W. Sheard, T. Gascoigne, W. Handley, W. Tebbs, H. Wormald, W. Yewdall. *Hon. Lanternist*—H. Wormald. *Hon. Treasurer*—J. H. E. Radcliffe. *Hon. Secretary*—F. G. Issott, 62 Compton Road, Harehills, Leeds. Meetings, weekly October to April; bi-weekly May to September.

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Leicester Literary and Philosophical Society (Photographic Section)—(Established 1899.)—Meetings held at the Council Room, Town Museum. *Chairman*—H. Alfred Roechling, C.E., F.G.S., &c. *Vice-Chairman*—J. Porritt. *Hon. Secretary*—G. Owston Marshall, "Carisbrooke," Victoria Road, Leicester.

Leigh Photographic Society.—(Established 1892.)—Meetings held at Market Buildings, Leigh. *President*—Dr. H. S. Hall. *Vice-Presidents*—Dr. J. Jones, Messrs. W. Hampson, R. Leigh, T. Lee Syms. *Committee*—C. Bruce, J. Berry, W. R. Moore, T. Peters, W. Yates, R. Calderbank. *Treasurer*—T. Haddock. *Secretary*—T. Mercer, 2 Clarence Street, Leigh, Lancs.

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Manchester Photographic Society.—(ESTABLISHED 1855.)—Meetings held in the Photographic Studio of the Manchester Municipal School of Technology. *President*—W. E. Wood. *Vice-Presidents*—Abel Heywood, Hermann Woolley, W. B. Wood. *Council*—B. J. Beckton, J. T. Bee, J. G. Chapman, T. Chilton, W. Rivers, J. Whittaker. *Treasurer*—W. G. Coote. *Secretary*—C. H. Coote, 10 Holmefield, Sale, near Manchester.

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Mansfield Camera Club (Late Mansfield and District Amateur Photographic Club.)—(Established 1898.)—Meetings held at the Oriental Café, West Gate, Mansfield. *President*—Alderman H. J. Patterson, *Committee*—Miss Heane, A. Buxton, J. T. Cook, H. Pye, J. W. Hudson, Dr. Palmer, G. A. Longden, P. J. Fenwick. *Hon. Lanternist*—J. A. Pegg. *Hon. Treasurer*—H. Alcock. *Hon Secretary*—A. Adlington, Care of Oriental Café, West Gate, Mansfield.

Marple and District Photographic Society.—(Established 1902.)—Meetings held at the Recreation Club, Church Lane, Marple. *President*—C. J. Atkinson. *Committee*—F. Allen, S. Broughton, G. Bryan, W. Fielding, A. Gee, B. Leech, F. Warren, J. W. Wood. *Hon. Treasurer*—J. B. Hope. *Hon. Secretary*—C. Taylor, Oak Lee, Mellor, near Stockport.

Mid-Cheshire Society of Art.—(Established 1895.)—Meetings held at the Pavilion, Winnington, Northwich. *President*—Thomas Arthur Johnson, *Committee*—Geo. B. Cliff. J.P., J. Hardie, H. J. Reid. E. T. Ward, and H. Yeomans. *Treasurer and Secretary*—George Holland, 17 Stanley Mount, Barnton, Northwich, Cheshire.

Midlothian Camera Club.—(Established 1889.)—Meetings held at 61 Leith Walk (Bank of Scotland). *President*—Thomas Wilson. *Vice-President*—Rev. W. Burnett. *Committee*—Office bearers. *Treasurer*—R. C. Ewart. *Secretary*—George Cleland, 61 Leith Walk (Bank of Scotland), Leith.

Monklands (Airdrie) N.B. Photographic Society.—Established 1892).—Meetings held at the Club Room, Victoria Place, Airdrie. *President*—James Jack, Esq. *Vice-President*—J. W. Eadie, Esq. *Council*—Messrs. W. B. Hossack, G. Jack, H. Louden, J. McGovern, J. Wilson Paterson, Frank Robertson. *Treasurer and Secretary*—J. Hugginson, 139 Graham Street, Airdrie, N.B.

National Photographic Record Association.—(Established 1897.)—*President*—Sir J. Benjamin Stone, M.P. *Council*—Right Hon. the Earl of Crawford, Sir E. M. Thompson, Sir H. T. Wood, H Baker, C. E. Fagan, L. Fletcher, A. V. Haslam, St. John Hope, Horsley Hinton, B. E. Lawrence, A. Mackie, J. W. Marchant, G. Middleton, Dr. Mill, P. Norman, R. Stone, H. S. Ward, Mrs. Ward, H. B. Wheatley. *Treasurer*—Alexander Graham, F.A.S. *Secretary*—George Scamell, 21 Avenue Road, Highgate, N.

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Newcastle-on-Tyne and Northern Counties Photographic Association.—(Established 1881.)—Meetings held at the Y.M.C.A., Blackett Street, Newcastle-on-Tyne. *President*—C. E. Barkas. *Vice-Presidents* —W. E. Cowan, S. M. Clague, W. S. Corder, W. Dotchin, J. J. Kirkwood. *Council*—T. Bulman, A. B. Gardiner, J. H. Holmes, James Baty, James Barr, J. W. Dyson, G. Hastings, D. A. Lowery, W. B. Chrichton, Henry Armstrong. *Treasurer*—Frank Milburn. *Secretary*—J. Hume Harbottle, 5 Bentinck Crescent, Newcastle-on-Tyne.

Newton Heath Camera Club.—(Established 1894.)—Meetings held at the Newton Heath Wesleyan School. *President*—Wm. Knowles. *Vice-Presidents*—J. Bebbington, A. G. Thistleton. *Committee*—J. R. Smith, W. T. Evans, J. Warren, W. A. Pass, W. Clarke. *Treasurer*—J. W. Cresswell. *Secretary*—J. Taylor, 103 Lightbowne Road, Moston, Manchester.

Northampton Natural History Society and Field Club (Photographic Section).—(Established 1872).—Meetings held at 1a Sheep Street, Northampton. *President* — H. Manfield, Esq., J.P. *Committee*—G. Nichols, C. Law, J. J. Wetherell, E. Archer, E. J. H. Felce, G. E. Holt, W. J. Lewis. *Treasurer and Secretary*—C. H. Dorman, A.R.I.B.A., 53 Abington Street, Northampton.

North Middlesex Photographic Society.—(Established 1886.)—Meetings held at Hanley Hall, Sparsholt Road, Crouch Hill, N. *President*—Chas. Beadle. *Vice-Presidents*—J. C. S. Mummery, F.R P.S , H. Stuart. *Council*—S. Barnard, S. H. Bentley, D. H. W. Broad, W. G. Cauldwell, L. J. Glendening, R. Hogg, A. G. Lawson, A. H. Lisett, J. W. Marchant, F.R.P.S., J. McIntosh, H. Smith. *Treasurer*—F. M. Ainsley. *Secretary*—T. Pring, 16 Ravenstone Road, Hornsey, N.

Nottingham Mechanics' Institution Camera Club.—(Established 1892.)—Meetings held at the Mechanics' Institution. *President*—S. Bourne, J.P. *Vice-Presidents*—G. H. Wallis, A. Pyatt, T. Wright, A. Brown, C. B. Wright, H. Tolley, H. Crewdson. *Committee*—A. W. Flowerdew, J. Anderson, E. H. Atkin, T. Wright, P. W. Crane, C. N. Wilde, J. E. Webb. *Hon. Treasurer*—A. Bush. *Hon. Secretary*—W. Ward, 14 Stratford Terrace, Nottingham.

Oldham Photographic Society.—(Established 1867.)—Meetings held at the Society's Room, Trust Company's Buildings, 13a Manchester Street, Oldham. *President*—J. Whitehead. *Vice-President*—Wm. Taylor. *Council*—T. Widdop, J. P. Robinson, R. T. Taylor, J. H. Brierley, J. H. Crabtree, F. Bradley. *Librarian*—J. Fullalove. *Treasurer* — S. Holroyd. *Honorary Secretary* — Spencer Ashton, 91 Waterloo Street, Oldham. *Assistant Secretary* — John Siddall, 147 Yorkshire Street, Oldham.

FOR
BROMIDE·PAPERS
·INVENTORS·AND·STILL·FIRST·

Oxford Camera Club.—(ESTABLISHED 1894.)—Meetings held at the University Museum. *President*—Sir W. J. Herschel, Bart. *Vice-Presidents*—Miss Acland, Colonel Impey, Miss Venables, Claude Rippon. *Committee*—E. A. Bevers, E. C. H. Jessop, H. T. Leach. H. Minn, Rev. W. M. Merry, Mrs. Poulton, A. Robinson. *Treasurer*—R. A. R. Bennett. *Secretary*—G. W. Norton, 149 Woodstock Road, Oxford.

Paisley Philosophical Institution (Photographic Section).—ESTABLISHED 1857.)—Meetings held at the Rooms of the Society, 28 Oakshaw Street, Paisley. *President*—David B. Jack. *Vice-President*—John S. Boyce. *Council*—Robert Easton, Rev. John Crouch, Wm. Hutchison, John Stewart, Andrew T. Jack, R. W. Steele, Thos. Carlile, jun., Wm. Young. *Treasurer*—Thos. Reid, jun. *Secretary*—Robert Milne, Savings Bank, Johnstone.

Peterborough Photographic Society.—(ESTABLISHED 1887.)—Meetings held at the Bedford Temperance Hotel, Queen Street. *President*—Geo. Kirkwood, Esq., M.D. *Vice-Presidents*—Dr. T. J. Walker, E. Worthington, T. W. Rogers. *Committee*—A. C. Taylor, A. W. Nicholls, Fredk. Sturton, J. F. Perkins, W. H. Pentney. *Hon. Treasurer*—H. C. Lilley. *Hon. Secretary*—T. J. Calcutt, 46 Narrow Street, Peterborough.

Photographic Club.—(ESTABLISHED 1879).—Meetings held at Anderton's Hotel, Fleet Street, E.C. *Trustees*—F. A. Bridge and H. Snowden Ward, F.R.P.S. *Committee*—A. L. Bell, G. E. Brown, F.I.C., G. Edey, E. W. Foxlee, A. Mackie, C. Wallis, G. Wynne, J. W. Zaehnsdorf. *Librarian and Curator*—Hans Müller. *Treasurer and Secretary*—T. W. Derrington, 49 Prince's Road. Wimbledon, S.W.

Photographic Copyright Union.—*President*—Frank Bishop. *Vice-President*—Alfred Ellis. *Committee*—Warwick Brookes, W. E. Downey, W. Magrath, F. M. Sutcliffe, C. M. Schomberg, J. Lillie Mitchell (Hon. *Treasurer*—Wm. Grove. *Secretary*—Henry Gower, 23 Soho Square, London, W.

Photographic Society of Ireland.—(ESTABLISHED 1854.)—Meetings held at 35 Dawson Street, Dublin. *President*—John J. Joly, D.Sc., F.R.S. *Vice-Presidents*—H. Vivian Yeo and H. Goodwillie. *Committee*—R. L. Bewley, C. Pearson, H. Pollock, W. H. Brayden, R Benson, Jas. Simpson, J. H. Woodworth, W. S. Haughton, M.D. *Ex-officio*, J. A. C. Ruthven, A. Werner, and Prof. J. Alfred Scott, M.D. *Treasurer*—Wm. Bewley, B.A. *Hon. Secretary*—E. Webb Smith, 35 Dawson Street, Dublin. *Assistant Hon. Secretary*—W. F. Cooper.

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Photographic Convention of the United Kingdom.—(ESTABLISHED 1886.)—The Nineteenth Annual Meeting will be held at Derby, in July, 1904, under the Presidency of Sir W. de W. Abney, K.C.B., R.E., D.C.L., F.R.S., &c. Retiring President, Sir Robert Pullar. The Photographic Convention was founded for the advancement of Photography, and to afford opportunities for personal intercourse and exchange of ideas amongst those interested in the art from all parts of the United Kingdom. Meetings have been held at the following centres:—Derby, Glasgow, Birmingham, London, Chester, Bath, Edinburgh, Plymouth, Dublin, Shrewsbury, Leeds, Great Yarmouth, Glasgow (second visit), Gloucester, Newcastle-on-Tyne, Oxford, Cambridge, and Perth. *Past Presidents*—J. Traill Taylor, Andrew Pringle. C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, W. Crooke, Thos. Bedding, Sir W. J. Herschel, Bart., and Sir Robert Ball. *Members of Council*—H. Walter Barnett (London), Harold Baker (Birmingham), G. B. Bainbridge (Newcastle-on-Tyne), Godfrey Bingley (Leeds), Henry Coats (Perth), W. J. Croall (Edinburgh), T. R. Dallmeyer (London), W. E. Dunmore (London), Alfred Ellis (London), S. H. Fry (London), F. Gandy (Derby), J. Pattison Gibson (Hexham), T. K. Grant (London), H. M. Hastings (London), E. J. Humphrey (London), T. Illingworth (London), Martin Jacolette (London), Sydney Keith (Hounslow), C. Phipps Lucas (London), Percy Lund (Bradford), Colonel Lysaght (London)), J. W. Marchant (London), A. F. Mowll (Liverpool), Rev. T. Perkins (Blandford), Arthur Priestly (Birkenhead), Ralph Robinson (Redhill), P. R. Salmon (London), F. H. Sanderson (Cambridge), A. Seaman (Chesterfield), Alexander Tate (Belfast), W. Taylor (Leicester), Dr. J. K. Tulloch (Dundee), J. H. Walker (Leeds), E. J. Wall (London), H. Snowdon Ward (London), Major-Gen. J. Waterhouse, I.S.C. (London), S. B. Webber (London), G. Watmough Webster (Chester), J. B. B. Wellington (Elstree), A. Werner (Dublin). Messrs. G. W. Norton (Oxford), H. A. Chapman (Cambridge), and Alex. M. Roger (Perth), are by Rule XII. *ex-officio* members of Council for one, two, and three years respectively. Vice-Presidents are by Rule X. members of Council *ex-officio*. *Trustees*—Samuel Blatchford Webber and Frederick Albert Bridge. *Hon. General Secretary and Treasurer*—F. A. Bridge East Lodge, Dalston Lane, London, N.E.

Photographic Survey and Record of Surrey.—(ESTABLISHED 1902.)—Meetings held at the Lecture Hall, Free Library, Town Hall, Croydon. *President*—The Right Hon. Viscount Midleton, Lord-Lieutenant, County of Surrey. *Vice-Presidents*—M.P.'s and County Mayors of the County of Surrey. *Executive Committee*—W. Whitaker, B.A., F.R.S., F.G.S. (Chairman), Hector Maclean, F.G.S., F.R.P.S., T. Bulbeck, H. Reatley Moore, B.A., B.Mus., L. Stanley Jast Curator). *Hon. Treasurer*—W. W. Topley. *Hon. Survey Secretary*—Harry D. Gower. *Hon. General Secretary*—J. H. Baldock, F.C.S., 3 St. Leonard's Road, Croydon.

FOR P.O.P GLOSSY. ·MATT· ·AND·SELF TONING·

Photographic Survey of Warwickshire.—(ESTABLISHED 1890.)—Meetings held at Norwich Union Chambers, Congress Street, Birmingham. *President*—Sir J. Benjamin Stone, M.P., J.P., F.R.G.S., F.L.S. *Vice-Presidents*—A. Jethro Cassins, F.R.I.B.A., G. F. Lyndon, J.P. *Committee*—A. Baker, O. Baker, H. J. Collins. J. Cruwys-Richards, E. R. Taylor, F. Lewis, B. Moore, W. A. Clark, Lewis Lloyd, T. Taylor, B. Shirley-Smith, Jonathan Pratt, S. H. Baker, C. Showall, G. Johnson, B.A., R. Haines, M.A. *Treasurer*—A. J. Leeson, *Hon. Curator*—P. T. Deakin. *Secretary*—Geo. Whitehouse, 7 Wye Cliff Road, Handsworth, Staffs.

Plumstead (All Saints') Photographic Society.—(ESTABLISHED 1896.)—Meetings held at the Mission Hall, Herbert Road. *Chairman*—H. Clutterbuck, M.I.M.E., M.I.Mech.E. *Council*—C. Arnold, E. Kemp, W. Grant, A. D. Pritchard, C. Stone. *Secretary and Treasurer*—G. V. Taylor, 29 Vernham Road, Plumstead.

Plymouth Photographic Society.—(ESTABLISHED 1894.)—Meetings held at the Athenæum, George Street. *President*—Frederick Johnson. *Vice-Presidents*—J. T. Johnson and H. S. Hill. *Committee*—F. Blanchard, F. C. Bowtell, W. Clayden, Chas. H. Dymond, Alfred W. Hicks, W. C. Johns, E. G. Turney, F. Wiblin. *Hon. Treasurer*—John Trouern Trend. *Hon. Secretary*—Wilfred Grist, 105 Old Town Street, Plymouth. *Assistant Hon. Secretary*—Alfred W. Hicks, 8 Chester Place, Plymouth. *Hon. Auditor*—W. Anning.

Plympton Photographic Society.—(ESTABLISHED 1894.)—*President*—Dr Aldridge. *Committee*—Dr. Ellery, J. Brooking Rowe, C. H. Stevens. H. Tritton. *Secretary and Treasurer*—T. H. Wilks, Plympton House, Plympton, South Devon.

Polytechnic Photographic Society.—(ESTABLISHED 1891.) — Meetings held at the Polytechnic, Regent Street, London, W. *President*—Howard Farmer. *Vice-Presidents*—Leon. H. Harris, Frank Hastings, A. Guy Symmons and W. M. Weir. *Committee*—J. Clark, C. E. Crake, G. J. Goose, C. A. Pinnion, G. W. Sutton and Ellis T. Williams, *Treasurer*—Rowland T. Hill. *Secretary*—Frank Wilson, 5 Balderton Buildings, Grosvenor Square, London, W.

Poole and Parkstone Natural History and Photographic Society.—(ESTABLISHED 1889.)—Meetings held at 142 High Street, Poole. *President*—Dr. W. Hooper Masters. *Vice-Presidents* — W. Carter, Rev. T. Perkins, M.A., Dr. W. Conway Hine. *Committee* (Photographic Section) — Mr. Hunt, Dr. Durell, Rev. T. Perkins, A. D. Moullin. *Treasurer*—George Parry. *Secretary*—J. Robey l Edridge, 142 High Street, Poole, Dorset.

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Postal Camera Club. —(ESTABLISHED 1894.)—A circulating Club for advanced workers only. The portfolios circulate with regularity. Prints are inserted and withdrawn by the members as the portfolio arrives monthly. *Hon. Secretary*—W. R. Bland, Duffield, Derby.

Postal Photographic Club.—(ESTABLISHED 1886.)—*Hon. Secretary and Treasurer*—R. A. R. Bennett, M.A. (Oxon), Walton Manor Lodge, Oxford.

Preston Scientific Society (Photographic Section).—(ESTABLISHED 1896.)—Meetings held at 119a Fishergate. *Chairman*—W. Phillips. *Vice-Chairman*—W. Entwisle. *Committee*—Miss Marsden, J. D. Marsden, P. P. Wilding, W. R. Easterby, W. Baron, W. A. Shuker. *Treasurer*—Ed. Myres. *Secretary*—A. W. Cooper, 31 Kenmure Place, Garstang Road, Preston.

Professional Photographers' Association.—(ESTABLISHED 1901.)—*President*—Alfred Ellis. *Past President*—W. Grove. *Vice-Presidents*—H. Walter Barnett, Wm. Crooke and T. C. Turner. *Committee*—Wm. Barry, F. A. Bridge, H. A. Chapman, S. Herbert Fry, Wm. Gill, H. Edmonds Hull, Martin Jacolette, Louis Langfier, Percy Lankester, Alexander Mackie, H. S. Mendelssohn, Frank P. Moffat, G. W. Morgan, A. F. Mowll, Ralph W. Robinson, Edgar Scamell, Lang Sims, H. C. Spink, W. D. Valentine, G. Watmough Webster, H. J. Whitlock, and Alfred Werner. *Hon. Solicitor*—P. E. Marshall. *Bankers*—National Provincial Bank of England. *Hon. Treasurer*—William Grove. *Hon. Secretary*—Alfred Ellis, 51 Baker Street, London, W.

Pudsey and District Photographic Society.—(ESTABLISHED 1898). Meetings held at the Mechanics' Institute, Pudsey. *President*—J. W. Golightly. *Vice-President*—J. R. Coulson. *Committee*—W. S. Crowther, J. B. Collins, H. A. H. Walker, W. Muff, J. W. Rawlings, W. Green, C. E. Whittam, J. Huggan. *Hon. Treasurer*—J. Cheeney. *Hon. Secretary*—F. C. Whittam, School House, Pudsey, near Leeds.

Queen's College, Belfast, Camera Club.—(ESTABLISHED 1901.)—Meetings held at Students' Union, Queen's College. *President*—John Wylie, B.A. *Vice-Presidents*—T. B. Vineycomb, M.A. and W. Caldwell, B.A. *Committee*—J. S. O'Neill, Wm. Riddell, J. K. Thompson, M. O. Wilson, A. E. S. Monie, J. B. Williams. *Treasurer and Secretary*—A. Stanley Gardiner, Students' Union, Queen's College, Belfast.

FOR
ENLARGEMENTS
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Reading and District Photographic Society.—(ESTABLISHED 1902).—Meetings held at the Abbey Gateway, The Forbury, Reading. *President*—Alfred Palmer. *Vice-Presidents*—George Gilligan, J.P., C. E. Keyser, J.P., M. H. Foquet Sutton. *Committee*—H. A. Barrs, A. Burton, E. Cardwell, C. A. Elliott, Capt. J. S. Henderson, H. A. King, E. W. Tabor, H. H. Thornbery. *Hon. Treasurer*—Geo. W. Webb. *Secretary*—Charles A. Reading, Broadlands, Caversham.

Redcar and Coatham Literary Institute Photographic Society (Yorkshire). (ESTABLISHED 1903.)—Meetings held at the Literary Institute, Redcar. —*President*—J. E. Stead, F.R.S. *Vice-Presidents*—Dr. L. de Legh, J. Shewell. *Treasurer*—A. Hick. *Secretaries*—Chas. E. Cowper, Coatham, Redcar, and P. H. Hutchinson, "Okeford," Coatham, Redcar.

Redhill and District Camera Club.—(ESTABLISHED 1899.)—Meetings held at Market Hall, Redhill. *President*—J. O. Grant. *Treasurer*—F. H. Ellwood, L.D.S. *Secretary*—H. J. Blackler, M.B., Braemfell, Redhill.

Richmond Camera Club.—(ESTABLISHED 1890.)—Meetings held at the Freemasons' Hall, Richmond, Surrey. *President*—F. P. Cembrano. *Vice-Presidents*—G. Ardaseer and Dr. G. H. Rodman. *Committee*—Messrs. A. Cheese, C. J. M. Child, H. Dale (Lanternist), A. H. Etherington, J. D. Gibson, and J. Sargent. *Treasurer*—J. B. Huddy. *Secretary*—E. G. Richardson, 13 Dynevor Road, Richmond, Surrey.

Ripon Portfolio Club.—(ESTABLISHED 1899.)—*Treasurer and Secretary*—H. Bulmer Rudd, 29 Westgate, Ripon.

Rishton and District Camera Club.—(ESTABLISHED 1900.)—Meetings held over 57 High Street, Rishton. *President*—Dr. Barr, J.P. *Vice-Presidents*—J. Whittaker, C.C., J. Hanson, Dr. Bowes, J. Cornall, A. Holt, T. Battersby, W. Hothersall, H. Halstead, J. Hacking, Coun, J. Marshall, *Committee*—G. Croft, W. H. Parker, W. Hothersall, S. Slater, S. Peel, D. Coleman, J. Hacking, R. T. Kenyon, *Lanternist*—Coun. J. Marshall. *Hon. Treasurer*—T. Battersby. *Hon. Secretary*—J. Parker, 88 Harwood Road, Rishton.

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Rodley, Farsley and Calverley District Photographic Society.—(Federated with the Yorkshire Photographic Union).—(ESTABLISHED 1893.) Meetings are held alternately at Rodley, Farsley, and Calverley. *President*—C. Gaunt, Springwood, Farsley. *Vice-Presidents*—G. W. Bentley (Farsley), B. O. Pearson (Farsley), S. Banks Hollings (Calverley), Rev. C. P. Morris, M.A. (Rodley). *Yorkshire Union Delegate*—John F. Ashby. *Hon. Treasurer*—Albert Matthews (Rodley). *Hon. Secretary*—H. Crossley (Rodley).

Röntgen Society.—(ESTABLISHED 1897.)—Meetings held at 20 Hanover Square, W. *President*—The Right Hon. Lord Blythswood, J.P., D.L., LL.D., F.R.A.S. *Vice-Presidents*—The Right Hon. The Earl of Crawford, K.T., F.R.S., J. Mackenzie Davidson, M.B., D. Ferrier, M.D., F.R.S., C. W. Mansell-Moullin, M.A., M.D., F.R.C.S., Prof. Silvanus P. Thompson, F.R.S., D.Sc., &c., Dawson Turner, M.D. *Past Presidents*—Professor Silvanus P. Thompson, F.R.S., D.Sc., &c., &c., C. W. Mansell-Moullin, M.D. Oxon., F.R.C.S, Wilson Noble, M.A., John Macintyre, M.B., F.R.S. Edin.. Professor Herbert Jackson, F.C.S. *Hon. Members.*—Professor Röntgen, Sir W. Crooks, F.R.S., C. V. Boys, F.R.S., Sir Oliver J. Lodge, F.R.S., Prof. Herbert Jackson, F.C.S., Professor Silvanus P. Thompson, F.R.S. *Council*—G. B. Batten, M.D., C.M., William Chattaway, C. A. Clark, L.D.S., J. H. Gardiner, F.C.S., A. W. Isenthal, F.R.P.S., H. H. Mills, M.D., Rev. P. Mulholland, B.A., E Payne, M.A., C. E. S. Phillips, G. H. Rodman, M.D., E. W. H. Shenton. L.R.C.P., M.R.C.S. (Librarian and Curator), H. Snowden Ward, F.R.P.S. *Hon. Treasurer*—J. J. Vezey, F.R.M.S., 188 Lewisham High Road, Brockley, S.E. *Hon. Secretary*—F. Harrison Low, M.B., 2 Henrietta Street, Cavendish Square, W.

Rotherham Photographic Society.—(ESTABLISHED 1889).—Meetings are held at 5 Frederick Street, Rotherham. *President*—E. Isle Hubbard, M.S.A. *Vice-Presidents*—James Leadbeater, W. Firth, and J. W. Stamp. *Council*—J. C. Cox, W. Mason, F. W. Thomlinson, A. S. Lyth. *Hon. Treasurer*—F. Oldham. *Hon. Secretary*—H. C. Hemmingway, Tooker Road, Rotherham.

Royal Cornwall Polytechnic Society.—(ESTABLISHED 1833.)—Meetings held at the Polytechnic Hall, Falmouth. *Patron*—His Most Gracious Majesty the King. *Vice-Patron*—His Royal Highness the Prince of Wales, K.G. *President*—Sir William H. Preece, K.C.B., F.R.S. *Vice-Presidents*—Sir Walter Trevelyan, Bart., Rev. J. S. Flynn, B.D., Alfred Bache, Assoc. Inst. C.E., Thurstan C. Peter, The Lord Bishop of Truro, Principal A. W. Rucker, D.Sc., F.R.S., Sir Richard Tangye, F. J. Bowles, Prof. C. Le Neve Foster, D.Sc., F.R.S., Edmund Backhouse, W. Ayerst Ingram, R.B.A., John Gill, F.C.S. *Treasurer*—Robert Milford Tweedy. *Secretary*—Edward Kitto, F.R. Met. Soc The Observatory, Falmouth.

FOR
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Royal Photographic Society of Great Britain.—(ESTABLISHED 1853.)—Meetings held at 66 Russell Square, London, W.C. *Patrons*—Their Majesties the King and Queen. *Vice-Patrons*—T.R.H. the Prince and Princess of Wales. *President*—Sir W. de W. Abney, K.C.B., D.C.L., F.R.S., F.R.A.S. *Vice-Presidents*—The Right Hon. the Earl of Crawford, K.T., F.R.S., Thomas R. Dallmeyer, F.R.A.S., Maj.-Gen. J. Waterhouse, I.A., Sir H. Trueman Wood, M.A. *Past Presidents*—Sir Charles Eastlake, P.R.A., 1853 to 1855; Sir Frederick Pollock, Lord Chief Baron, 1855 to 1869; James Glashier, Esq., F.R.S., 1869 to 1874 and 1875 to 1892; John Spiller, Esq., F.I.C., F.C.S., 1874 to 1875; Sir W. de W. Abney, K.C.B., 1892 to 1894 and 1896; Sir H. Trueman Wood, M.A., 1894 to 1896; the Right Hon. The Earl of Crawford, K.T., F.R.S., 1897 to 1900; Thomas R. Dallmeyer, Esq., F.R.A.S., 1900 to 1903. *Ordinary Members of Council*—J. T. Ashby, H. Walter Barnett, C. H. Bothamley, F.I.C., F.C.S., James Cadett, St. Lawrence Carson, B.A., B.Sc., Charles Churchill, Leslie E. Clift, Douglas English, B.A., T. E. Freshwater, F.R.M.S., Thomas K. Grant, A. Haddon, Sir W. J. Herschel, Bart., G. Lindsay Johnson, M.A., M.D., J. C. S. Mummery, C. H. Oakden, E. Sanger Shepherd, Joseph W. Swan, M.A., F.R.S., A. A. K. Tallent, Prof. W. C. Unwin, B.Sc., F.R.S., B. Gay Wilkinson. *Editor of the Journal*—Sir W. de W. Abney, K.C.B., D.C.L., F.R.S., F.R.A.S. *Hon. Solicitor*—Francis Ince. *Hon. Treasurer*—John Sterry. *Hon. Auditors*—Messrs. Calder Marshall, Son and Ibotson, Chartered Accountants, 90 Cannon Street, E.C. *Secretary and Librarian*—A. W. W. Bartlett, 66 Russell Square, London, W.C.

Rugby Photographic Society.—(ESTABLISHED 1901).—*Presdent*—B. B Dickenson, M.A. *Vice-President*—L. Cumming, M.A. *Committee*—F. Betts, E. C. Crowhurst, A. W. Fell, J. T. Fleet, G. A. Towers. *Hon. Treasurer*—C. H. Ham. *Hon. Secretary*—R. H. Myers, 31 Bridget Street, Rugby.

Scarborough and District Photographic Society.—Meetings held at the Museum, Scarborough. *President*—Harry Wanless. *Vice-President*—J. H. Rowntree. *Committee*—Messrs. E. R. Cross, C. E. Collings, F. Foster, H. P. Hopkins, A. E. King, J. Pickering, C. E. Wanless, G. Whitfield. *Treasurer*—John Whitfield. *Secretary*—Thomas Frederick Brogden, 92 North Marine Road, Scarborough.

Scottish Photographic Federation.—(ESTABLISHED 1903).—Meetings held as arranged by Council. *President*—Henry Coates (Perthshire). *Vice-Presidents*—G. D. Macdougald (Dundee and East of Scotland), and D. Horn (Glasgow Southern). *Council*—J. Kirk (Brechin), A. Pender (Aberdeen), Robt. Milne (Paisley), J. W. Eadie (Monkland), S. Stewart (Kirkcaldy), D. McDonald (Shettleston). *Treasurer*—Arch. Campbell. *Secretary*—John B. Maclachlan, Blairgowrie.

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Shaw Church Institute Photographic and Art Society.—(Established 1888.)—Meetings held at Shaw Church Institute. *President*—Mr. J. W. Farrar. *Vice-President*—Mr. J. R. Heaton. *Committee*—Messrs. J. H. Broadbelt, H. Buckley, J. R. Royds. *Treasurer and Secretary*—John Maiden, 91, Rochdale Road, Shaw.

Sheffield and Hallamshire Photographic Society.—(Established 1896.)—Meetings held at the Cemetery Road Baptist Schools, Sheffield. *President*—Mr. F. Mottershaw. *Vice-Presidents*—Messrs. G. H. Bagshaw, G. Tomlinson, and J. B. Barlow. *Committee*—Messrs. J. W. Mottershaw, L. Britton, R. Heathcote, G. E. Bingham, A. Bingham, A. Anderson, F. Billing, and C. D. Rose. *Treasurer and Secretary*—Fred. Lowe, 41 Carrington Road, Sheffield.

Sheffield Optical Lantern Society.—(Established 1890.)—Meetings held at St. Paul's Schools, Cambridge Street, third Thursday in the month. *President*—Dr. J. A. Manton. *Vice-Presidents*—J. H. Lygo, J. W. H. Wilson, Hy. Staniforth, B. Carr, J. Clowes. *Council*—J. Temperton, M. Wilson, C. Thornhill, J. E. Glenn, T. W. Simonson, J. Cunningham, S. Hughes. H. J. Claque, J. W. Copley. *Reporter*—J. Cunningham *Treasurer*—E. Copley. *Secretary*—T. G. F. Allen, 59 Melrose Road, Sheffield.

Sheffield Photographic Society.—(Established 1864.)—Meetings held at the Builders' Exchange, Cross Burgess Street. *President*—Dr. H. G. Paterson. *Vice-Presidents*—G. Tomlinson, J. R. Wigful, G. H. Day. *Council*—J. W. Wright, W. T. Furniss, J. G. Jackson, A. de Silva, J. W. Charlesworth. *Treasurer*—T. G. Hibbert. *Secretary*—T. U. Simonson, 69 Woodstock Road, Sheffield.

Shropshire Camera Club.—(Established 1886.)—Meetings held at Castle Chambers, Shrewsbury. *President*—H. W. Hughes. *Vice-Presidents*—F. R. Armytage, J. R. Greatorex, M. J. Harding, Rev. A. J. Moriarty, D.D. *Council*—W. Carter, E. Cureton, M.D., J. L. Della-Porta, W. E. Harding, John Heath, Wallace Heath, H. H. Hughes, R. J. Irwin, P. W. Pilcher, Major W. T. Southam. *Treasurer*—H. Atkin. *Secretary*—W. D. Haydon, The Schools, Shrewsbury.

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FOR P.O.P GLOSSY. ·MATT· ·AND·SELF TONING·

Society for the Encouragement of Arts, Manufactures, and Commerce.—(FOUNDED IN 1754. INCORPORATED BY ROYAL CHARTER IN 1847.)—Meetings are held at John Street, Adelphi, London, W.C. *Patron*—His Most Gracious Majesty The King. *President*——H.R.H. The Prince of Wales, K.G. *Vice-Presidents*—H.R.H. The Duke of Connaught and Strathearn, K.G., Duke of Abercorn, K.G., C.B., Sir William Abney, K.C.B., D.C.L., D.Sc., F.R.S., The Lord Chief Justice, G.C.M.G., Sir Benjamin Baker, K.C.M.G., F.R.S., Sir George Birdwood, K.C.I.E., C.S.I., M.D., LL.D., Sir Edward Birkbeck, Bart., Sir Frederick Bramwell, Bart., D.C.L., F.R.S., Major-Gen. Sir Owen Tudor Burne, G.C.I.E., K.C.S.I., Michael Carteighe, F.C.S., Lewis Foreman Day, Professor James Dewar, LL.D., F.R.S., Hon. Sir Charles W. Fremantle, K.C.B., The Lord Chancellor, Henry Graham Harris, Lord Kelvin, G.C.V.O., D.C.L., LL.D., F.R.S., Sir William Lee-Warner, K.C.S.I.,, Hon. Richard Clere Parsons, Sir William Henry Preece, K.C.B., F.R.S., Sir Walter S. Prideaux, Lord Rothschild, The Lord Mayor (Sir Marcus Samuel), Sir John Wolfe-Barry, K.C.B., F.R.S. *Ordinary Members of Council*—Sir Steuart Colvin Bayley, K.C.S.I., C.I.E., Sir Mancherjee Merwanjee Bhownaggree, K.C.I.E., M.P., Sir Alexander R. Binnie, R. Brudenell Carter, F.R.C.S., Henry Hardinge Samuel Cunynghame, C.B., Professor Francis Elgar, LL.D., F.R.S., Professor Clement Le Neve Foster, D.Sc., F.R.S., Sir Robert Giffen, K.C.B., LL.D., F.R.S., Robert Kaye Gray, Col. Sir Thomas Hungerford Holdich, R.E., K.C.M.G., K.C.I.E., C.B., Sir Westby B. Perceval, K.C.M.G., Alexander Siemens. *Treasurers*—Sir Owen Roberts, M.A., D.C.L., F.S.A., Carmichael Thomas. *Secretary*—Sir Henry Trueman Wood, M.A. *Assistant Secretary*—Henry B. Wheatley, F.S.A. *Assistant Secretary for the Indian and Colonial Sections*—Samuel Digby. *Chief Clerk*—George Davenport, *Accountant*—J. H. Buchanan. *Auditors*—Knox, Cropper & Co.

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South Devon Teachers' Camera Club.—*President*—A. W. Searley. *Secretary*—C. Mole, School House, Broadhempston, S. Devon.

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South London Photographic Society.—(Affiliated with the Royal Photographic Society.)—Meetings held at Collyer Hall, Collyer Place, High Street, Peckham. *President*—Maurice Howell, Esq., M.P.S. *Vice-Presidents*—Messrs. Howell, Gardner, Slater, Allen, and French. *Committee*—(ex officio, as past president) C. H. Oakden, F.R.P.S., J. K. Ayling, E. R. Bull, C. F. Dickinson, H. E. Edmead, H. Esler, A. Fellows, J. T. French, J. O. Gardner, F. Goddard, B. Lyon, G. H. Moss, J. D. Rees, W. F. Slater, E. S. Tardrew, C. W. Walker. *Curator and Librarian* W. C. Boyce. *Lanternist*—A. V. French. *Excursion Secretary*—H. C. Beckett. *Treasurer*—C. Churchill, F.R.P.S. *Secretary*—W. Calder Marshall, F.C.A., 41 Glenton Road, Lee, S.E. Nat. Telephone: 6129 Bank.

South Manchester Photographic Society.—(ESTABLISHED 1901).—Meetings held at the West Didsbury Public Hall, Burton Road, West Didsbury. *President*—Dr. G. H. Lancashire. *Vice-Presidents*—Messrs. P. Jordan and J. R. Gibbs. *Committee*—Messrs. F. Hesse, F. Higginbottom, C. Horkheimer, S. Jewsbury, E. Lee, W. J. Pearce, and J. W. Young. *Hon. Treasurer*—Mr. F. O. Pickard. *Hon. Secretary*—Mr. C. L. Groundwater, Goulden Road, Withington.

South Norwood Photographic Society.—(ESTABLISHED 1899.)—Meetings held at the Constitutional Club, 10 South Norwood Hill, South Norwood, S.E. *President*—John Smith, Esq. *Vice-Presidents*—Messrs. J. T. Sandell, H. Smith, E. Clark, H. Clark, J. W. Black. *Committee*—Messrs. W. Arnold, C. Batchelor, F. Hendricks, W. E. Nicholls, G. R. Nicholls, G. Robinson, W. Reed, H. Scott, E. Shannon, C. Morgan Smith. *Treasurer*—Mr. F. C. Bause. *Secretary*—Mr. G. R. Beckett, 28 Birchanger Road, South Norwood, S.E.

Southport Photographic Society.—(ESTABLISHED 1890.)—Meetings held at Queen's Hall, Nevill Street. *President*—H. Payne, M.D. *Vice-Presidents*—J. Lambert and J. Noton. *Committee*—D. E. Benson, A.M.I.C.E., C. H. Brown, J. R. Cave, M.P.S., J. M. Fawke, and R. W. Woods. *Treasurer*—Willis Brunt. *Secretary*—Geo. Cross, 15 Cambridge Arcade.

Southport Y.M.C.A. Camera Club.—(ESTABLISHED 1896.)—Meetings held at the Y.M.C.A. Rooms, Eastbank Street, Southport. *President*—S. J. Elliott. *Vice-Presidents*—Henry Ball and S. R. Parks. *Committee*—S. Y. Ormerod, E. W. Mellor, P. Dickinson, T. E. Harrison, W. H. G. Lea. *Treasurer*—J. T. Rigby. *Secretary*—F. B. Jesper, 8 Promenade, Southport.

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Southsea Photographic Society.—(ESTABLISHED 1888.)—Meetings held at 5 Pembroke Road, Portsmouth. *President*—H. T. Lilley, M.A., *Vice President*—Dr. C. H. Newby, F.R.C.S. *Committee*—S. O. Black, W M. Cliffe, G. Stanford, E. H. Purvis, A. A. Lawton, F. J. Lawton, P. R. Denham, L. J. Steele. *Treasurer*—F. S. Hoyte *Secretary*—F. J Mortimer, 10 Ordnance Row, Portsea. *Hon. Lanternist*—E. H. Purvis.

South Shields Photographic Society.—Meetings held at the Y.M.C.A. Rooms, Charlotte Terrace, South Shields. *President*—W. Hoare. *Vice-Presidents*—A. E. Cowling, H. G. Fowler, A. J. Hunter, W. Parry, C. W. Wood, Dr. Macdonald, Rev. Father Chapman. *Committee*—A. Joures, G. S. Robinson, A. G. Anderson, M. M. Barbour, H. Railton, W. Hunter. *Treasurer*—M. H. Sadler. *Secretaries*—R. Brady, 2, Albion Terrace, South Shields; A. W. Hoare, 53 Wouldhave Street, South Shields.

Michael's Photographic Society.—(ESTABLISHED 1896.)—Meetings held at the Church Institute, 45 St. Michael's Road, Liverpool. *President*—Rev. Herbert Gresford Jones. *Committee*—The Secretary and Treasurer, H. Winstanley, the Curator, C. Dixon, and Messrs. Cole, Dening, Williams, and W. Winstanley. *Curator*—Mr. Cecil Dixon. *Secretary and Treasurer*—Mr. Herbert Winstanley, 14, St. Michael's Road, Liverpool, S.

Stafford Photographic Society.—(ESTABLISHED 1895.)—Meetings held at the Old Police Barracks, Telegraph Street. *President*—T. W. Davies. *Vice-President*—G. E. Hann. *Committee*—H. Cliff, H. W. Cooper, A. J. Dean, and W. Kirkham. *Treasurer*—G. Wray. *Secretary*—Henry E. Burn, 41 Stone Road, Stafford.

Stereoscopic Club.—Meetings held at the Star Hotel, Manchester. *Secretary*—W. J. Chadwick, Star Hotel, Manchester.

Stereoscopic Society.—(ESTABLISHED 1893.)—*President*—W. Stainthorpe, M.D., J.P. *Vice-Presidents*—Herr Victor Selb, F. Dunstervil. *Treasurer and Secretary*—B. Diveri, B.A., Viewfield, Huntly, N.B.

Stockport Photographic Society.—(ESTABLISHED 1889).—Meetings held at the Mechanics' Institute. *President*—Dr. Brennan. *Council*—J. Barlow, J. Fairclough, T. Gould, R. Gardner, W. Holt, S. Platt, C. F. Read. *Treasurer*—A. W. Slater. *Hon. Secretary*—J. J. Rothwell Norris Avenue, Stockport.

Stratford G.E.R. Mechanics' Institution (Photographic Section).—(Affiliated with the Royal Photographic Society.)—*President*—J. Holden, M.I.C.E., M.I.M.E. *Vice-Presidents*—A. J. Hill, S. D. Holden, F.R.P.S., A. P. Parker, H. Wilmer. *Committee*—H. West (Chairman), C. Harding, H. H. Wicks, E. Neville, E. E. Morgan, H. D. Banks, T. McAllister, C. S. Bent, C. A. Edwards, P. J. Perry. *Delegates to the R.P.S.*—H. D. Banks, A. Woolford. *Hon. Lanternists*—T. McAllister, H. Davis. *Hon. Curator*—H. West. *Instructor*—H. W. Bennett, F.R.P.S. *Hon. Treasurer*—T. R. Bourne. *Hon. Secretary*—A. Woolford, 16 Grove Green Road, Leytonstone, E.

Sun & Company.—(ESTABLISHED 1886.)—A Postal Photographic Society for advanced workers, limited to forty amateurs, for the monthly circulation and criticism of photographs, entirely the work of members, and for a general interchange of ideas, with a view to mutual advancement in the science and art of photography. *Committee*—H. Newson, Wallace Heath, Ernest Marriage, and the Hon. Secretary. Application for vacancies should be made to the Hon. Secretary, Martin J. Harding, Egerton House, Havelock Road, Shrewsbury.

Sunderland Camera Club.—(ESTABLISHED 1899.)—Meetings held at Walton's Buildings, High Street, West Sunderland.—*President*—Wm. Thackray. *Chairman*—C. T. Cothay. *Vice-Chairman*—R. Liddell. *Committee*—Messrs. W. Thackray, Cothay, Liddell, Bushell, Möller, Ord, Yeaman. *Librarian*—T. Klee. *Recorder*—Mr. Bushell. *Treasurer*—O. Möller. *Secretaries*—Selby Ord and K. S. Yeaman, 52 Frederick Street, Sunderland.

Sunderland Photographic Association.—(Affiliated with the Royal Photographic Society.)—(ESTABLISHED 1888.)—Meetings held at the Subscription Library. *President*—William Milburn. *Vice-Presidents* William Bartram and Thomas Walton. *Council*—W. C. Brown, J. Deans, T. Fitzgibbon-Forde, W. Horan, J. W. Hunter, C. Laing, A. Peddie, R. G. Posgate. *Hon. Auditor*—W. Carter. *Hon. Treasurer*—W. Pope. *Hon. Secretary*—William E. Kieffer, 1 Stirling Street, Sunderland.

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Swadlincote and District Photographic Society.—(ESTABLISHED 1902).—Meetings held at Hill Street Baptist Schoolroom. *President*—G. S. Bragge. *Vice-Presidents*—H. H. Raphael, Dr. H. Moir, H. Tooth, J. H. Nickolls. *Committee*—Messrs. H. Bradford, R. Baker, A. Mountford, A. Gretton, F. W. Edwards, E. Hobart. *Treasurer*—A. Gretton. *Secretary*—F. J. Edwards, 64 Coppice Side, Swadlincote.

Talbot Album Club.—(ESTABLISHED 1886.)—*Secretary*—Frederick H. Davies, Hampton-in-Arden, Warwickshire.

"The Argosy" Postal Photographic Club.—(ESTABLISHED 1887.)—*Secretary*—Rev. C. F. Lowry Barnwell, Stramshall Vicarage, Uttoxeter.

The Guild, Leeds.—*Committee*—Messrs. J. H. Gash, P. Sheard, W. M. Coultas. *Treasurer and Secretary*—R. Stockdale, 17 Mount Preston, Leeds.

Thornton Heath Photographic Society.—(ESTABLISHED 1899.)—Meetings are held at 86 High Street, Thornton Heath. *President*—W. H. Rogers. *Vice-Presidents*—W. H. Smith, F. O. Bynoe. *Committee*—H. P. C. Harpur, G. F. Course, C. Drew, J. H. Robertson, F. Stokes, J. Read, A. Russell, G. Lépine Smith, Mrs. Edwards, Miss Stokes, G. W. Watson. *Hon. Treasurer*—T. Ironmonger. *Hon. Secretary*—Walter Wood, 45 Beulah Road, Thornton Heath.

Torbay Camera Society.—*President*—Col. W. Fothergill Macmullen. *Secretary*—Chas. R. Rowe, Cockington, Torquay.

Tunbridge Wells Amateur Photographic Association.—(ESTABLISHED 1887.)—Meetings held at the Club Room, Mechanics' Institute. *Patron*—Sir David Salomons, Bart., M.A., J.P., D.L. *President*—F. G. Smart, M.A., J.P. *Vice-Presidents*—E. R. Ashton, Rev. A. T. Scott, S. J. Snelgrove. *Committee*—J. H. Chapman, E. C. Jenkinson, A. W. Pierson, J. H. Spencer. *Hon. Auditor*—Edward Catchpole. *Hon. Lanternist*—A. W. Pierson. *Treasurer*—B. Whitrow. *Secretary*—Joseph Chamberlain, Tankerville, Cambridge Street, Tunbridge Wells. *Hon. Assistant Secretary*—H. Wild.

Tyneside Camera Club.—Meetings held at Rye Hill. *President*—Alex. B. Gardiner. *Vice-Presidents*—J. Purvis, W. Bell. *Treasurer*—W. Carr, *Secretary*—Jos. F. McKie, 9 Rye Hill Cottages, Newcastle-on-Tyne.

Tyneside Geographical Camera Club.—(ESTABLISHED 1897.)—Meetings held in the Reading Room, Geographical Institute, Barras Bridge, Newcastle-upon-Tyne. *President*—His Grace the Duke of Northumberland. *Secretary and Treasurer*—John Scott, 10 Mosley Street, Newcastle-upon-Tyne.

Ulster Amateur Photographic Society.—(ESTABLISHED 1885.)—Meetings held at the Museum, College Square North, Belfast. *President*—David Elliott, B.A. *Ex-Presidents*—Professor E. A. Letts, D.Sc., Ph.D., F.R.S.E., F.C.S., F.I.C., Cecil E. Shaw, M.A., M.D., John Brown, F.R.S., F.P.S., A.M.I.E., W. E. Williames, William Gray, M.R.I.A., W. B. Galway, M.A., Alex. Tate, C.E., *Committee*—Miss E. Haslett, Miss W. Haslett, S. W. Allworthy, M.A., M.D., Major-General Bland, R.E., William McLean, J. W. Storey, B.A., H. Struver. *Hon. Librarian*—C. Mitford Martin. *Hon. Lanternist*—C. Mitford Martin. *Treasurer*—J. Campbell Carson. *Secretary*—Thomas Nolan Murray, The Museum, College Square North, Belfast. *Irish Tourist Correspondents* (stamp for reply)—Secretary and Hon. Librarian.

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West London Photographic Society.—(ESTABLISHED 1888.)—Meetings held at Broadway Lecture Hall, Hammersmith. *President*—J. Brown. *Vice-President*—Geo. Lamley, F.R.P.S. *Council*—M. W. Cockerell, E. E. Gibbs, D. C. Isaacs, J. R. Lynch, A. Minnis, L. Selby, W. Tomes, E. Walker. *Hon. Treasurer*—A. E. Cockerell. *Hon. Secretary*—F. C. Hart, 37 Willcott Road, Acton Hill, W.

West Surrey Photographic Society.—(ESTABLISHED 1887.)—Meetings held at the Railway Tavern, 110 Battersea Rise, S.W. *President*—J. T. Price. *Vice-Presidents*—R. H. Baskett, J. Bulbeck, W. H. Goy, W. T. Marriott and Dr. H. Pelham Webb. *Committee*—C. A. Clear, G. W. Coleman, V. Nichols, S. Smith, F. G. Tryhorn. *Hon. Librarian*—V. T. Serin. *Hon. Lanternist*—T. Digby Mottram. *Hon. Treasurer and Secretary*—W. H. Wilshere, 236 Lavender Hill, S.W.

Weymouth Photographic Society.—(ESTABLISHED 1895.)—Meetings held at the Technical Schools. *President*—C. E. E. Mercer. *Vice-Presidents*—A. Pearson, H. J. Groves, A. Dennis. *Committee*—Messrs. Gibbs, Williams, Rogers, Bolt, and Harp, Misses Russell, Martin, Levi. *Treasurer*—D. F. Allen. *Secretaries*—F. C. Mace and J. Talbot.

Whitby Camera Club.—(ESTABLISHED 1898.)—Meetings held at Cliff Street Board Schools. *President*—Wm. Brown. *Vice-Presidents*—J. Bruce, H. S. Horne. *Committee*—W. Ruff, O. Syer, J. T. Ross, J. Brooks, A. Gray, F. Falkingbridge, and H. S. Horne. *Treasurer and Secretary*—G. S. French, Architect, 1 West Terrace, Whitby.

Whitstable Photographic Society.—(ESTABLISHED 1900.)—Meetings held at the Foresters' Hall. *Vice-Presidents*—F. Thurston, A. A. Kemp. *Committee*—Commander Gubbins, R.N., G. Barton, F. Church, R. Reeves. *Treasurer and Secretary*—R. T. Wheeler, L.R.C.P., &c., Ansdell House, Whitstable, Kent.

Widnes Photographic Society.—(ESTABLISHED 1893.)—Meetings held at, Bedford Chambers, Victoria Road. *President*—H. T. Mannington. *Vice-Presidents*—L. West, A. J. Squires. *Committee*—H. S. Barker, J. Gandy, R. J. Gow, E. MacDonald J. Newburn, A. Hewitt. *Treasurer*—T. Cosier. *Secretary*—J. W. Towers, Croft Street, Widnes.

Wigan and District Camera Club.—(ESTABLISHED 1899.)—Meetings held at Hope Hall, Woodstock Street. *President*—Walter Booth. *Vice-Presidents*—Arthur Smith, Matthew Walters, Francis Fidler, Geo. Rigby. *Committee*—Messrs. Alb. Walls, E. J. Halliwell, F. Simm, Robt. Dawson, and T. Hampson. *Lanternists*—Herbert Cookson and Wm. Simm. *Reporting and Recording Secretary*—T. H. Winstanley. *Hon. Secretary*—Wm. Baron, Mab's Cross, Wigan.

Wimbledon and District Camera Club.—(ESTABLISHED 1903.)—Meetings held at 53 The Broadway, Wimbledon. *President*—Eric Hambro, Esq., M.P. *Vice-Presidents*—Walter Dowson, Esq., A.C.C., Reginald Craigie, Esq., A. Cadett, Esq. *Committee*—Messrs. Thatcher (Chairman), Deacon, Reiner, Rule, Sexton, Millhouse, Webb, Packer, Frith, Knight. *Treasurer*—Ernest J. Hawkins. *Secretary*—J. Munro, 96 Richmond Road, Wimbledon, S.W.

Wolverhampton Photographic Society.—(ESTABLISHED 1901.)—Meetings held at the Y.M.C.A., Darlington Street. *President*—Harold Holcroft, M.A., F.C.S. *Council*—T. Henry Cox, J. Gale, D. Murrey, H. M. Painter, L. J. Reade, Dr. Lurton, J. M. Taylor, J. G. Wright. *Treasurer*—F. T. Gibson. *Secretary*—A. Eaton Painter, 43 Lichfield Street, Wolverhampton.

Woodford Photographic Society.—(ESTABLISHED 1893.)—Meetings held at the Wilfrid Lawson Hotel, Woodford. *President*—F. G. Emler. *Vice-Presidents*—A. Horsley Hinton and W. L. F. Wastell. *Council* E. Marriage, F.R.P.S., H. Wilmer, F.R.P.S., E. H. Carpenter, P. G. R. Wright. *Affiliation Delegates*—J. P. W. Goodwin and E. C. Winney. *Lanternist*—R. A. Malby. *Treasurer and Secretary*—H. T. Malby, F.R.P.S., Blyden Villas, Chelmsford Road, Woodford, N.E. *Assistant Hon. Secretary and Librarian*—E. H. R. Hillsworth.

Woolwich Photographic Society.—(Affiliated to the Royal Photographic Society.)—(ESTABLISHED 1892.)—Meetings held at St. John's Lecture Room, Wellington Street, Woolwich. *President*—Chas. Churchill, F.R.P.S. *Vice-Presidents*—W. H. Dawson, J. Desforges, F. W. Machen, J. B. Panting, F.R.P.S. *Council*—J. Baker, W. Beard, J. Cregan, G. F. Meinertzhagen, S. Saffron, H. Weekes. *Hon. Treasurer*—F. W. Machen. *Hon. Secretary*——G. W. Tapp, 79 Durham Road, Plumstead, S.E.

Worcestershire Photographic Survey Society. — (ESTABLISHED 1896.)— Meetings held at the Victoria Institute, Worcester. *President*—The Right Hon. Earl Beauchamp, K.C.M.G. *Vice-Presidents* — Earl Dudley, Lord Cobham, Howard Lloyd, Esq., J.P., T. J. Hobson, Esq., J. W. Bund, Esq., J.P. *Treasurer*—Mrs. Berkeley, Atheridge Court, Worcester. *Secretaries*—C. R. Sawyer and T. Duckworth. *Corresponding Secretary*—C. R. Sayer, Finstall Mount, Bromsgrove.

Worcester Tricycle Club (Camera Section).—(ESTABLISHED 1892.)—Meetings held at the Bell Hotel. *President*—J. Wilkes. *Committee*—J. Cam, S. Hill, T. James, J. F. Santonna. *Treasurer*—F. E. Hill. *Secretary*—T. J. Hobson, 15 Albany Terrace, Worcester.

Yeadon and District Photographic Society. — (ESTABLISHED 1896.)— Meetings held at the Lecture Hall, Yeadon. *President*—Mr. George Proctor. *Vice-Presidents*—Messrs. Fearnley, Dr. Muschamp, E. E. Slater, and Wainwright. *Committee*—Messrs. T. A. Womersley, E. Langley, Jno. Best, J. Berry, W. Yeadon. *Treasurer and Secretary*— Mr. Arthur Marshall, 10 Swaine Hill Crescent, Yeadon.

York Photographic Society.—(ESTABLISHED 1887.)—Meetings held at the Victoria Hall, York. *President*—Watson Hirst. *Vice-Presidents*—B. Brooke and A. H. Hardcastle. *Council*—J. Cannell, H. Loadman, C. McDermid, R. Redpath, C. R. Watkinson. *Lanternist* — J. Dickinson. *Treasurer*—R. N. Shirt. *Secretary*—F. G. P. Benson, 50 Scott Street, York. *Assistant Secretary*—R. R. Tyrer.

Yorkshire Philosophical Society (Photographic Section).—(ESTABLISHED 1888.)—Meetings held at the Museum, York. *President*—Tempest Anderson, M.D., J.P. *Vice-President*—J. N. Kitching. *Treasurer and Secretaries*—H. Dennis Taylor, Stancliffe, Mount Villas, York, and Malcolm Spence, Almerygarth, Marygate, York.

COLONIAL PHOTOGRAPHIC SOCIETIES.

Amateur Photographic Association of Victoria.—(ESTABLISHED 1883.)—Meetings held at the Royal Arcade, Bourke Street, Melbourne. *President*—J. W. Eggleston. *Vice-Presidents*—H. C. Mais, M.Inst.C.E., and R. Ferguson. *Committee*—J. Glover, C. B. Goslett, E. C. Joshua, F. A. Kernot, J. H. Mulvany, T. Stephens, H. J. Trowbridge, J. Wilkinson. *Treasurer*—E. K. Byrne. *Secretary*—F. W. Miscamble, F.I.A.V., 325 Collins Street, Melbourne.

Auckland Camera Club.—(ESTABLISHED 1885.)—Meetings held at the Y.M.C.A. Hall *President*—E. W. Payton. *Vice-Presidents*—Messrs. Josiah Martin, F. Wright, M. Trenwith, Dr. Purchas, and Rev. Patterson. *Committee*—Messrs. Frith, Hill, Rayner, and Walker. *Librarian, Treasurer and Secretary*—W. Takle, Breakwater Road, Auckland, N.Z.

Ballarat Photographic Society.—(ESTABLISHED 1880.)—Meetings held at the School of Mines, Ballarat. *President*—Professor A. Mica Smith. *Treasurer*—J. Foster. *Secretary*—Frederick J. Martell, School of Mines, Ballarat.

Bendigo Amateur Photographic Association.—(ESTABLISHED 1894.)—Meetings held at the School of Mines, McCrae Street. *President*—Mr. J. B. Edwards, *Vice-President*—Mr. T. Hall. *Committee*—Messrs. R. E. Jeffery, W. Vale, W. Heffernan, D. Roberts, Watts, Miss Barlow. *Treasurer and Secretary*—James Miller, Bath Corner, Bendigo, Victoria, Australia.

Bombay Photographic Society.—(ESTABLISHED 1903.)—Meetings held at the Techno-Chemical Laboratory, Girgaum, Bombay.—*President*—Prof. T. K. Gajjar, M.A., B.Sc., F.C.S., &c., &c. *Vice-Presidents*—Prof. V. N. Hate, B.Sc., H. N. Billimoria, M.A., B.Sc., F.C.S., J. D. Bharda, B.A., Joint Principal, New High School. *Committee*—The Officers and Manubhai Nanabhai, B.A., LL B , R D. Kanga, B A., R. P. Photographer, A. H. Nazar. *Hon. Treasurer*—Krishnalal Nanabhai, M.S.C.I. *Hon. Secretaries*—Bomanji Dorabji Padamji, Vasanji P. Dalal, M.A., B.Sc., Techno-Chemical Laboratory.

Canterbury Philosophical Institute (Photographic Section), Christchurch, New Zealand.—Meetings held on second Tuesday in each month. *Hon. Secretaries*—S. Page and R. C. Bishop.

Cape Town Photographic Society.—(ESTABLISHED 1890.)—Meetings held at the Y.M.C.A. Buildings. *Hon. President*—Sir David Gill, K.C.B., F.R.S. *Vice-President*—Professor W. S. Logeman. *Council*—G. Campbell Dickson, J. P. Edwards, E. C. Matson, E. H. Short, E. J. Steer, J. A. Yallop, Dr. R. Marlotto, Rev. W. Forbes. *Lanternist*—G. Ainslie. *Treasurer*—A. W. B. Smuts. *Hon. Secretary*—A. J. Fuller, P.O Box 470, Cape Town.

COLONIAL PHOTOGRAPHIC SOCIETIES—*continued.*

Christchurch Photographic Society.—(ESTABLISHED 1901.)—Meetings held at Rooms, 154 Worcester Street, Christchurch. *President*—G. W. Bennett. *Vice-Presidents*—R. C. Bishop and F. E. Graham. *Committee*—G. W. Jenner, J. Griffiths, J. N. Taylor, A. C. McIntyre, and T. G, Strange. *Treasurer*—G. A. Bünz. *Secretary*—H. E. Gott, 164 Hereford Street, or Box 110, G.P.O., Christchurch, N.Z.

Dai-Nippon Shashin Kyokwai (Photographic Association of Japan).—(ESTABLISHED 1893.) — Meetings held at Kwazoku - Kwaikan, 1 Uchiyamashitacho, Tokyo. *President*—H. E. Prince M. Nijo. *Vice-President*—H. E. Viscount M. Nagaoka. *Committee*—H. E. Count U. Toda, H. E. Viscount Enonomoto, H. E. Baron Hanabusa, Captain S. Toya, Dr. T. Kato, M. Nakajima, R. Konishi, H. Shigyo, H. E. Count S. Omura, H. E. Viscount Okabe, Rigakuhakushi D. Kikuchi, K. Ogawa, I. Tanaka, Dr. Marumo, S. Kiga, S. Kajima. *Treasurer*—S. Ohashi. *Secretary*—K. Ogura, 77 Minami-Enokimachi, Ushigome, Tokyo.

Dunedin Photographic Society.—(ESTABLISHED 1890.)—Meetings held at Liverpool Street, Dunedin. *President*—R. Chisholm. *Vice-Presidents* C. O. McKellar and J. Laing. *Committee*—A. J. Barth, R. A. Ewing, W. Gow, W. Allen, R. E. Fletcher, S. Richards, W. Livingston: *Treasurer*—R. A. Ewing. *Secretary*—J. Skottowe Webb, National F. & M. Insurance Company of New Zealand, Dunedin.

Foochow Camera Club.—(ESTABLISHED 1892.)—Meetings held at Foochow. China. *President*—Wm. Muller. *Vice-President*—L. A. Mackinnon. *Committee*—President, Vice-President, Treasurer, and Secretary. *Secretary and Treasurer*—Wilbur T. Gracey, Foochow, China.

Gordon College Amateur Photographic Association.—(ESTABLISHED 1889.) —Meetings held at Gordon College, Geelong. *President*—H. G. Roebuck. *Vice-Presidents*—R. J. Smith and T. Lord. *Committee*—Messrs. Thacker, Price, McPhillimy, Mockridge, Brinsmead. *Treasurer*—S. R. J. Mawson. *Secretary*—J. Hammerton, jun., "Burngreave," 73 Little Kyrie Street, Geelong, Victoria, Australia.

Hamilton Association Camera Club.—(ESTABLISHED 1892.)—Meetings held at Hamilton Association Rooms, Public Library. *President*—J. M. Eastwood. *Vice-Presidents*—A. H. Baker and W. White. *Treasurer*—George Lees. *Secretary*—W. Henry Edwards, 168 Main Street, East, Hamilton, Ontario, Canada.

Hawkes Bay Camera Club.—(ESTABLISHED 1895.)—Meetings held at Napier, N.Z. *President*—F. W. Williams. *Vice-President*—J. Vigor-Brown. *Committee*—S. E. Cooper, H. J. Bull, C. Saunders. *Secretary and Treasurer*—T. Bruce Bear, c/o Gas Company, Napier, New Zealand.

Ipswich and West Moreton Amateur Photographic Society, Ipswich Queensland.—(ESTABLISHED 1893.)—Meetings on the second Wednesday of each month. *Hon Secretary*—E. Bostock, Brisbane Street, Ipswich, Queensland, Australia.

COLONIAL PHOTOGRAPHIC SOCIETIES—*continued.*

Johannesburg Photographic Society.—(ESTABLISHED 1899.)—Meetings held at the Society's Rooms, Reliance Buildings, Kerk Street. *President*—J. Percy Fitzpatrick. *Vice-Presidents*—Dr. Kendal Franks, C.B., &c., and Rev J. C. Harris. *Committee*—The above and Dr. H. W. Bloomfield, W. Newby-Fraser, P. N. Heath, T. E. Goodall, J. Johnson Hoyle, E. Mills, W. R. Prior, R. D. Harris, J. H. L. Manisty, P. Greathead. *Hon. Secretary and Treasurer*—H. C. Haddon, Box 4822, Johannesburg.

Kimberley Camera Club.—(ESTABLISHED 1890.)—Meetings held at the Club Rooms. *President*—James Lawrence, M.L.A. *Chairman*—Montague Thane. *Vice-Chairman*—F. H. Hancox. *Council*—J. Chllds, E. Goffe, L. Atkinson. *Secretary and Treasurer*—Charles Howie, P.O. Box 233, Kimberley, S.A.

Maritzburg Camera Club.—(ESTABLISHED 1893.)—Meetings held at Messrs Stantial and Allerston's, Church Street, Pietermaritzburg. *President*—A. Allerston. *Committee*—W. E. Marsh, J. Watkinson, W. Hay, A. R. Hopkins, A. E. Smith. *Treasurer*—W. E. Marsh. *Secretary*—Rupert S. Johnson, Box 159, Pietermaritzburg, Natal, South Africa.

Montreal Camera Club.—(ORGANISED 1890. INCORPORATED 1892.)—Place of Meeting, 4 Phillips Square, Montreal, Canada. *President*—George Sumner. *Vice-President*—A. W. Cole. *Committee*—Edward Barry, David R. Brown, G. W. Davis, Robert W. Elliott, N. N. Evans, F. T. Jennings, James J. Mason, Archibald McLean, C. K. Temple, R. Wilson, jun. *Secretary and Treasurer*—A. Clarence Lyman, 157 St. James Street, Montreal, Canada.

Nelson Camera Club.—(ESTABLISHED 1888.)—Meetings held at the Club Rooms. Hardy Street, Nelson. *President*—C. Y. Fell. *Committee*—H. Brusewitz, H. V. Gully, H. A. Hobbs, E. Mules, C. A. Redworth. *Treasurer*—F. W. Hamilton. *Secretary*—F. B. Glasgow, c/o The Union Bank of Australia, Ltd., Nelson.

Northern Tasmanian Camera Club.—(ESTABLISHED 1889.)—Meetings held at the Club Rooms, Launceston, Tasmania. *President*—F. C. Birchall. *Vice-Presidents*—P. C. Maxwell, R. C. Kermode, H. B. Brownrigg. *Committee*—Chas. Hart, J. E. Heritage, J. H. Lithgow. *Treasurer and Secretary*—F. Styant Browne, 112 Brisbane Street, Launceston, Tasmania.

N.S.W. Lands Department Photographic Society, Sydney.—Meetings held on the last Thursday in each month. *Chairman*—J. R. Yorke. *Committee*—O. W. Ballhausen, E. T. Davis, M. V. Murphy, H. P. Rich, R. W. Vale. *Hon. Secretary and Treasurer*—William Hamilton, Lands Department, Sydney.

N.S.W. Railway and Tramway Camera Club.—(ESTABLISHED 1894.)—Meetings held at the Railway Institute, Radfern. *President*—H. McLachlan. *Vice-President*—H. Carruthers. *Committee*—Messrs. Marsh, Burrell, Petterson, Leslie. *Treasurer*—J. Paterson. *Secretary* A. Johnson, Power House, Rushcutters Bay.

Perak Amateur Photographic Society.—(ESTABLISHED 1895.)—Meetings are held in Poverty Flat, Museum Road, Taiping. *President*—L. Wray, jun., M.I.E.E., F.Z.S. *Committee*—M. J. Wright, M.B., C.M., R. O. N. Anderson, A.M.I.C.E., F. Duberly, W. van Dart. *Hon. Secretary and Treasurer*—George Bain, Taiping, Perak.

COLONIAL PHOTOGRAPHIC SOCIETIES—*continued.*

Photographic Association of Canada.—(ESTABLISHED 1883.)—Place of Meeting, London, Ontario, Canada. *President*—H. S. Park (Toronto). *Vice-Presidents*—J. F. Jackson (Barrie) and W. Still (Orangeville). *Executive Committee*—H. S. Park, J. F. Jackson, W. Still, J. H. Ramsay, T. D. Hastings. *Treasurer*—J. H. Ramsay (Toronto). *Secretary*—Thomas D. Hastings, 169 Dundee Street, London, Ontario, Canada.

Photographic Society of India.—(ESTABLISHED 1887.)—Meetings held at 57 Park Street, Calcutta. *President*—N. Giannacopulo. *Vice-Presidents*—A. Norman, G. B. Symes Scott. *Committee*—A. Caspersz, J. E. Clarke. C. H. Coates, Captain A. W. C. McCormick, R.E., I. A. Pope, W. J. Simmons, A. Thomson, J. Williamson, T. H. Wilson. *Treasurer*—C. Anninos. *Secretary*—A. J. Oliver, 57 Park Street, Calcutta. Number of Members, 450.

Photographic Society of New South Wales.—(ESTABLISHED 1894.)—Meetings held at 149 King Street, Sydney. *President*—His Honour Mr. Justice Docker. *Vice-Presidents*—Sir James Fairfax, Colonel T. F. Knox, Messrs. William Kilgour, R. N. Kirk, E. T. Davis, J. S. Stening. *Committee*—Messrs. P. H. Bushell, C. W. Middleton, A. J. Perier. William Johnson. and E. H. MacPherson. *Treasurer*—W. C. Fisher, *Secretary*—Fred. W. Proctor, Box 829, G.P.O., Sydney,

Photographic Union of New South Wales, Sydney.—Meetings held on the first Thursday of each month. *Hon. Secretary*—Charles H. Kerry.

Queensland Photographic Society.—(ESTABLISHED 1883.)—Meetings held at the Technical College, Ann Street, Brisbane. *President*—C. D. Ferguson. *Vice-Presidents*—Dr. John Thomson and Dr. Wilton Love. *Committee*—T. F. Illidge, H. W. Mobsby, A. W. M. Clark, W. E. Evans. *Treasurer*—J. L. Kinloch. *Secretary*—W. C. Voller, Queen Street, Brisbane, Queensland.

South Australian Photographic Society (affiliated with the Royal Photographic Society of Great Britain, and with the South Australian Society of Arts, Incorporated.)—(ESTABLISHED 1885.)—Meetings held at the S.A. Society of Arts Rooms, Institute Buildings, North Terrace, Adelaide, South Australia. *President*—Mr. S. Smeaton, B.A. *Vice-Presidents*—Messrs. W. B. Poole, and J. Gazard. *Committee*—The Executive Officers and Messrs. E. Atterton, F. W. Dancker, T. B. Ragless, and C. F. Rainsford, *Hon. Librarian*—R. Bowen. *Hon. Treasurer*—F. Gabriel. *Secretary*—P. H. Evans, care of the South Australian Chamber of Manufactures (Incorporated), Exhibition Buildings, North Terrace, Adelaide, South Australia.

Southland Camera Club, Invercargil, New Zealand.—Meetings held on the third Monday in each month. *Hon. Secretary*—A. M. Macdonald, Esk Stores.

St. John Camera Club.—(ESTABLISHED 1893.)—Meetings held at 65 William Street, St. John, New Brunswick. *Secretary*—J. Kaye-Allison, P.O. Box 401, St. John, N.B., Canada.

Toronto Camera Club.—(ESTABLISHED 1887.)—Meetings held at the Forum Building, Yonge Street, Toronto, Ontario. *President*—Edmund E. King, M.D. *Vice-Presidents*—J. G. Ramsey and E. Stanger. *Committee*—W. H. Moss, G. R. Baker, W. Bohne, H. B. Lefroy, W. McTaggart, H. Hampshire. *Secretary and Treasurer*—John J. Woolnough, 32 Cottingham Street, Toronto.

COLONIAL PHOTOGRAPHIC SOCIETIES—*continued.*

Upper Canada College Camera Club.—(ESTABLISHED 1891.)—Meetings are held at Upper Canada College, Toronto, Ontario, Canada. *Secretary*—O. M. Biggar, 249 Simcoe Street, Toronto, Ontario, Canada.

Wanganui Camera Club. (Affiliated with the Royal Photographic Society).—(ESTABLISHED 1894.)—Meetings held at Jackson's Rooms, Ridgeway Street. *President*—S. S. Griffiths. *Vice-President*—T. Allison. *Committee*—T. W. Downes, T. Allison, G. Pownall, F. W. Denton, R. M. Murdock, F. J. Kersley. *Treasurer and Secretary*—C. W. Babbage, Roto Kawau, Wanganui, New Zealand.

Wellington Camera Club.—(ESTABLISHED 1892.)—Meets second Thursday in each month at Exchange Buildings, Wellington, New Zealand. *President*—A. de Bathe Brandon. *Vice-Presidents*—A. C. Gifford, M.A., and J. McLellan. *Committee*—Thomas Pringle, G. W. Barltrop, M. C. Smith, W. McGregor Wright, A. B. Keyworth, M. Buckley Joyce. *Treasurer*—T. M. Hardy. *Secretary*—Joseph Alfred Heginbotham, Tea Gardens. Kilbirnie, Wellington, New Zealand.

West Australian Photographic Society, Perth.—(ESTABLISHED 1894.)—Meetings held on the third Wednesday in each month. Annual Meeting in September. *Hon. Secretary*—A. R. L. Wright, Public Works Department, Perth.

Westland Camera Club, Hokitika, New Zealand.—*President*—James Park. *Hon. Secretary*—James King.

Working Men's College Photographic Club.—(ESTABLISHED 1892.)—Meetings held in the Lecture Hall, at the College, Latrobe Street, Melbourne, Victoria. *President*—Professor Kernot, M.A., M.E. *Vice-Presidents*—F. A. Campbell, C.E., T. C. Camm, A. J. Campbell, A. W. Craven, M.P., and D. Le Souef, C.M.Z.S. *Committee*—Messrs. J. Davis, T. J. Eastham, J. Alexander, E. C. Joshua, and Miss Edwards. *Hon. Instructor*—James Aebi. *Lantern Engineers*—A. B. Sturtevant, J. Glover, H. Hampson, and Mr. H. Serle. *Librarian*—Miss E. Cassidy. *Press Correspondent*—W. H. Gregson. *Hon. Chairman of Judging Committee*—Robert Harvie. *Hon. Treasurer*—J. Petersen. *Hon. Secretary*—Arthur J. Relph, Government Printing Office, Melbourne; or 33 Palermo Street, South Yarra. *Assistant Secretary*—C. R. Du Rieu.

ORANGE CAMERA CLUB.

CONTINENTAL PHOTOGRAPHIC SOCIETIES.

Amateur Fotografen Vereeniging te Amsterdam.—Established September 1, 1887. Place of Meeting, Handboogstraat, 2 Moet Spui. Ign. Bispinck, President. K. Job, jun., Treasurer. T. P. Goedhoop, Breedeweg 36, Watergraafsmeer, near Amsterdam, Secretary.

Amateur Photographen Vereeniging "Daguerre."—Established 1890. Meetings held at Groningen (Nederland). G. P. Smith, President. R. Roelfsema, Vice-President. R. P. von Assen, Committee. J. H. J. Gorter, Treasurer. N. de Jager, Hint. Jansstraat Groningen, Secretary.

Amateur-Fotografen-Vereeniging, "Rotterdam," in Rotterdam—President—A. van den Bok. Treasurer—Johs. A. P. Otten. Secretary—A. A. van Nahnijs, Ammanstraat 28.

Association Belge de Photographie.—Established 1874. Meetings are held at the Palais du Midi, Brussels. J. Casier, President. MM. J. Maes et Ch. Puttemans, Vice-Presidents. MM. Dupret, van Eyll, Goderus, Peltzer, Roland, Selb. Committee. M. Nyst, Treasurer. M. Vanderkindere, 97 Avenue Brugmann, Bruxelles, Secretary.

Association Nationale des Photographes Amateurs.—Fondée le 15 Mars, 1894, et autorisée par arrêté préfectoral du 22 Décembre, 1894. Place of Meeting, au domicile du Président, actuellement à Châteaugiron (Ille-et-Vilaine). Alfred Savary, President. M. Jousseaume, Vice-President. MM. Cosnard, Le Sage de la Haye, Marnelle, and Le Millier, Committee. Roul de la Hellière, au Château de Châteaugiron (Ille-et-Vilaine), Secretary and Treasurer.

Dansk Fotografisk Forening.—Established April 5, 1879, Place of Meeting, Haandveerkerforeningen, Kronprinsensgade 7, Kjòbenhavn. Carl Sonne, President. U. C. Bauer, Vice-President. Max Schon, Committee. O. Gjòrup, Treasurer. J. Lanerberg, Kongens Nytorv 13, Kjòbenhavn, K., Secretary.

Deutsche Gesellschaft von Freunden der Photographie in Berlin.—Meldungen zum Beitritt für die Deutsche Gesellschaft von Freunden der Photographie nehmen die Mitglieder des Vorstandes entgegen und versenden dieselben auf Wunsch die 'Satzungen" der Gesellschaft. Näheres durch den Schriftführen Herrn Direktor Schultz-Hencke, Lette-Institut, Berlin S.W., Königgrätzer-strasse 90, Der Jahresbeitrag beträgt M.20,00. für Auswärtige jährlich M.14.

Deutscher Photographen Verein.—Established December 29, 1876.—Place of Meeting, Weimar. K. Schwier, President. E. Sonntag, Vice-President. C. Kesselhuth, Hildesheim; Ferd. Dyck, Luxemberg; Herbert Rosenthal, Guben; Joh. Gaedicke, Berlin, Committee. K. Schwier, Weimar, Treasurer and Secretary.

Dresdner Gesellschaft zur Förderung der Amateur-Photographie, e. V.—Established 1897. Meetings held at 1b Moritzstrasse, I Et. (Löwenbräu), E. Frohne, President. Hermann Schnauss, Vice-President. Max Hermann, Treasurer. Dr. V. Bellach, Hon. Secretary. All letters, &c., should be addressed to the President (E. Frohne), Dresden, A., Schumannstrasse, 24.

Fachverein der Photographen zu Berlin (Abtheilung des Deutschen Photogr. Gehilfen Verbandes).—Established December 1, 1893. Gustav Camphausen, President. Paul Schützman, Vice-President. Eduard Günther, Treasurer. Kuzelowsky, Secretary.

Haarlemsche Amateur Fotografen Club.—Established 1891. Place of Meeting, Haarlem Societeit Vereeniging. N. van der Sleen, President. Maurits H. Binger Treasurer, Frans Huijsser, Secretary.

Münchener Photographische Gesellschaft.—Established 1879. Place of Meeting, München. Adalbert Werner, President. Otto Wernhard, Treasurer. E. Kieser, Secretary. Address of Society, Deutsches Haus, Carlsplatz, München,

Photo Club de Paris.—Established 1888. Place of Meeting, 44 Rue des Mathurins. Maurice Bucquet, President. Emmanuel Mathieu, Vice-President. MM. Bucquet, E. Mathieu, P. Bourgeois, P. Naudot, H. Guérin, A. Darnis, M. Binder, R. Demachy, P. Gers, C. Puyo, A. Toutain, Committee. Henri Guérin, Treasurer. Paul Bourgeois, 80 Boulevard, Malesherbes General Secretary. Paul Naudot, Secretary.

Photographische Gesellschaft. — Established 1861. Place of Meeting, Wien. Dr. T. M. Eder, President. Robert Sieger, Vice-President. Alexander Angerer, Michael Frankenstein, Georg Fritz, Arthur Baron Hübl, Ignaz Leykauf, Wilhelm Müller, Albert Edler von Obermayer, Max Perlmütter, Karl Pietzner, Josef Ungar, Eduard Valenta, Committee. Ludwig Schrank, Treasurer. Wilhelm Burger, Wien, II., Karmelitergasse, 7, Secretary.

CONTINENTAL PHOTOGRAPHIC SOCIETIES.—*continued.*

Photographische Gesellschaft, Hamburg, Altona.—Established November 4, 1873. Place of Meeting, Hamburg, Jungfernstieg, 40. F. A. Dahlström, President. Willy Wilcke, Vice-President. C. Färber, Treasurer. S. Hamann, Secretary. Address of Society, F. A. Dahlström, Hamburg, Zeughausmarkt.

Photographischer Verein zu Berlin.—Established 1863. Place of Meeting Berlin, Architecten Vereinshaus. Paul Grundner, President. T. Reichard, Vice-President. T. C. Schaarwächter, Dr. S. Steinschneider, Paul Schückert, Hpsm, u Dr. Himly, Dr. A. Miethe, Dr. A. Hesekiel, and F. Cornand, Committee. E. Martini. Treasurer. Director Schultz-Hencke, Berlin, S.W., Königgratzerstrasse, P.V., Secretary.

Société Française de Photographie.—Established 1854. Place of Meeting, 76 Rue des Petits Champs, Paris, 2e. M. le Colonel Laussedat, President. MM. Bardy et Bordet, Vice-Presidents. MM. Davanne, Sebert (le Général), Bardy, Bordet, Pector, Londe, Drouet, Roy, Colson, Audra, Balagny, Fribourg, Gauthier-Villars, Haincque de Saint-Senoch, Houdaille, Rolland, Thouroude, Vallot, Gobert, Villechotle, Cousin, Committee. G. Roy, Treasurer. S. Pector, 9 Rue Lincoln, à Paris, 8e Arrondissement, Secretary,

Société Genevoise de Photographie.—Established 1879. Meetings are held at Grand Mézel 1, Genève. John Bosson, President. Dr. A. Mazel, Vice-President.

Société Nantaise de Photographie.—Established 1881. M. du Hanley, Lieut.-Colonel, President. M. Toublanc, Vice-President. Ch. Planté, H. Bureau, P. du Minehy, Committee. M. Tassain, Treasurer. Paul Crémant, Rue d'Alger, 43, Nantes, Secretary, and Pierre Courant, Assistant Secretary. Réunion le premier vendredi de chaque mois, au Cercle des Beaux-Arts.

Société Photographique, d'Arcachon.—Established 1899. Place of Meeting, 10 Rue du Casino, Arcachon. Capitaine Billioque, President. L. Escarraguel and Docteur Hameau, Vice-Presidents. M. de Marc, Treasurer. M. Dumora, Secretary.

Société Photographique Professionelle.—Established 1878. Place of Meeting, Place St. Gervais, 6, à Genève. E. Dovaz. President. Charles Racine, Vice-President. Louis Barral, Treasurer. Antoine Chevalley, Siège de la Société, Secretary.

Société Versaillaise de Photographie.—Established 1884. Séances de la Société les premiers Mardis de chaque mois à la Mairie à 8 heures et demie du soir. Maurice Bucquet, President. L. Ottenheim, Vice-President. Comité d'administration Committee. M. Gavin, Treasurer. Jessé Curely, 20 Rue de Provence, Versailles, Secretary.

Sploro Photo Club. Porto Alegre, Rio Grande do Sul, Brazil,—Established 1888. Juvenal Leal, President. Dr. Arthur Pinto da Rocha, Vice-President. Luiz Nascimento Ramos, Treasurer. Dr. Jose Paranhos, Secretary. Luiz Manuel de Souza, Waldemar Barcellos, and Dr. Conrad Penafiel, Council.

Union Nationale des Sociétés Photographiques de France.—Established 1892. Meetings are held at 76 rue des Petits Champs, Paris, 2e. Janssen, President. MM. Bucquet, Perrin, Vice-Presidents. Janssen, Bucquet (M.), Perrin, Pector (S.), Laedlein, Berthaud (M.), Cousin (E.), Demay, Deslis, Dulieux, Gers (P.), Hupier, Roy (G.), Viney, Wallon, Permanent Committee. Berthaud (M.), Treasurer. Pector (S.), 9 Rue Lincoln, Paris, 8e, Secretary.

Verein zur Förderung der Photographie zu Berlin. — Established 1869. Place of Meeting, Berlin. Martin Kiesling, Rittmeister a. D, President. Wirkl. Geheim, Ober-Regierungsrat, Dr. Brandt, Vice-President. Dr. Ellon, Kammergerichtsrat Hautherorne, Dr. Hesekiel, F. Loescher, Dr. Statius, H. Stegemann, Committee. Gustav Schmidt, Treasurer. Paul Hanneke, Berlin, W., Winterfeldtstrasse, 35, Secretary.

Verein zur Pflege der Photographie und verwandter Künste.—Established 1875. Place of Meeting, Frankfort-on-Main. Prof. F. Schmidt, President. Herm. Maass, Vice-President. C. Böttcher, Treasurer. Th. Haake, Frankfort-on-Main, Kaiserstrasse, Secretary.

Vijmeegsche Amatenr Photogr. Vereeniging, "M. L."—Established 1893.—Meetings held at Vijmigen Grootestraat, 5. Jacq. Kneppers, President. J. A. Vijftigschild, Vice-President. Vande Graaff Lent, Treasurer. Baron v. Hemert tot Dingshof, Secretary, Pontannsstraat.

AMERICAN PHOTOGRAPHIC SOCIETIES.

Agassiz Association, Manhattan Chapter (Photographic Section), New York.—Established 1881. Meetings held at 141 East Fortieth Street, New York City. C. F. Groth, President. C. Kromm, Vice-President. C. F. Groth, R. Kitchelt, E. B. Miller, W. S. Miller, H. T. Rowley, H. Brennich. F. G. Fruhan, Miss M. Leeson, Miss H. Hargrove, Committee. W. S. Miller, Treasurer. E. B. Miller, 141 East Fortieth Street, New York City. Corresponding Secretary.

Akron Camera Club.—Meetings are held at residences of members on the second Tuesday of each month. Edward A. Terrass, President. Henry Canfield, Vice-President. Frank Adams, Treasurer. Margaret Mitchell, 150 South Summit Street, Akron, Ohio, U.S.A., Secretary.

Albany Camera Club.—Organised 1887, Incorporated 1891. Meetings held at the Club House, 72 Chapel Street. Colonel Augustus Pruyn, President. Charles W. Reynolds, Vice-President. Committee—The Officers and seven other members elected at Annual Meeting in April. Dr. T. L. Carroll, Treasurer. M. H. Rochester, c/o The Embossing Company, Secretary. Annual meeting first Friday in April.

Amateur Photographic Association.—Established December 29, 1887. Meetings held at 916 Broad Street. William S. Monk, President. S. A. Sexton, Vice-President. Miss Mary Morgan Keipp, Librarian. Captain S. Orlando Trippe, Selma, Dallas County, Alabama, Secretary and Treasurer.

American Institute (Photographical Section).—Established 1859. Meetings held at 19 and 21 West Forty-fourth Street, near Fifth Avenue, New York City, U.S.A. Oscar G. Mason, President. Robert A. B. Dayton, Vice-President. James Y. Watkins, Treasurer. John W. Bartlett, M.D., F.R.P.S., 149 West Ninety-fourth Street, New York City, U.S.A., Secretary.

American Lantern Slide Interchange.—Established 1885. Meetings held at 361 Broadway, New York. F. C. Beach, General Manager. F. C. Beach, W. H. Cheney, W. H. Rau, John P. Zenner, Herbert F. Smith, Board of Managers. The Interchange consists of thirty American and Canadian Clubs, among which are exchanged a set of 100 selected lantern slides monthly for exhibition and educational purposes. Annual meeting is held in November of each year, when 2,000 slides are examined and arranged in sets for use.

Atlantic City Photographic Society.—Established 1895. Meetings held at Atlantic City, N.J. Herbert N. Morse, President. Ferdinand Stodler, Vice-President. Leonard Dalger, Treasurer. Herbert Somers, 26 S Indiana on Atlantic City, N.J., Secretary.

Bethlehem Photographic Society.—Established January 1890. Meetings held at the residences of members. Rev. A. D. Thaeler, President. Rev. S. U. Mitman, Vice-President. The Executive Committee is composed of the five Officers of the Society. E. A. Ran, Lantern Slide Director. A. G. Kemever, Treasurer. R. P. Stout, 332 Market Street, Bethlehem, Pa., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Birchwood Beach Camera Club.—Established 1900. Meetings held at Harbert, Michigan, U.S.A. W. Bradford, President. M. L. Sizer, Harbert Michigan, Secretary.

Boston Camera Club.—Established 1881. Meetings held at the Club Rooms, 50 Bromfield Street, Boston, Mass. William R. Richards, President. Frederick S. Anable, Chas. H. Currier, Francis H. Manning, Vice-Presidents. The Officers and Dr. Percy E. Brown, Owen A. Eames, George H. Goodhue, Walter B. Swift, Gurdon Russell Fisher, William P. Robinson, Committee. Charles H. Chandler, Treasurer. Charles Hall Perry, 50 Bromfield Street, Boston, Mass., U.S.A.

Bridgeton Camera Society.—Established 1890. Meetings are held at the Bridgeton Cumb. Company, New Jersey. Henry W. Scull, President. Sidney H. Ogden, Vice-President. Charles C. Woodruff, Emerson B. Gamson, Frank E. Riley, Committee. Hugh L. Reeves, Treasurer. James Boyd Patter, Bridgeton, N.J., Secretary.

Brockton Camera Club.—Established April, 1894. Meetings are held at Room 1, Smith Building, Center Street. Robert E. Brayton, President. A. L. Evans, Dr. J. S. Thorndike, Vice-Presidents. The Officers, and C. H. Lawrence, G. W. Laring, S. H. Eaton, E. F. Stacey, E. W. Farwell, Committee. C. L. Perry, Treasurer. E. W. Farwell, Wyman Street, Brockton, Mass., U.S.A., Secretary.

Brooklyn Academy of Photography.—Incorporated 1888. Meetings held at 177 Montague Street, Brooklyn, N.Y., U.S.A. S. B. Price, M.D., President. Alex. M. Cook and Wm. Bogart Walker, Vice-Presidents. John Merritt, M.D., Sherman Esselstyn, C. G. Balmano, Edward Esmonde, S. L. Hodges, Trustees. Russell E. Prentiss, Curator and Librarian. A. S. Ingram, Treasurer. H. M. Valentine, Recording Secretary. J. M. Tallman, 166 McDonough Street, Brooklyn, N.Y., U.S.A., Corresponding Secretary.

Brooklyn Institute of Arts and Sciences (Department of Photography.—Established 1887. Meetings held at 201 Montague Street, Brooklyn, New York. Charles H. Morse, President. William J. Bryant, Vice-President. Charles H. Morse (Chairman), J. W. Kent, W. J. Bryant, J. H. Norris. J. C. Oswald, William C. Peckham, F. A. Perret, A. C. Ruprecht, Mrs. C. H. Burdett, Mrs. E. W. Maddren, Executive Committee. John H. Norris, Treasurer. A. C. Ruprecht, 379 Hancock Street, Brooklyn, New York, U.S.A., Secretary.

Buffalo Camera Club.—Established 1888. Meetings held at Franklin Street. John A. Stein, President. Harlow H. Boyce and H. Wilson Saunders, Vice-Presidents. John A. Stein, Harlow H. Boyce, H. Wilson Saunders, William G. Houck, John P. Zenner, Conrad L. Baer, Philip J. Knapp, Henry H. Gurnther, C. R. Knapp, James Savage, Louis F. Jansen, Louis B. Hart, Committee. Conrad L. Baer, 1 Genesee Street, Buffalo, N.Y., Secretary and Treasurer.

California Camera Club.—Established March 18, 1890. Meetings held at the Academy of Sciences Building, San Francisco, California. W. B. Webster, President. H. B. Hosmer and J. J. Lermen, Vice-Presidents. The Officers, and G. Knight White, J. R. Gwynn, F. C. Bangs, H. L. Byrne, Directors. I. O. Crosscup, Librarian. E. G. Eisen, Treasurer. W. E. Palmer, Academy of Sciences Building, San Francisco, California, Secretary. Chas. A. Goe, Academy of Sciences Building, San Francisco California, Corresponding Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Camera Club of New York.—Established May 7, 1896. Meetings held at 3 West Twenty-ninth Street, New York City. C. H. Crosby, President. J. Edgar Bull, Vice-President. C. H. Crosby, J. Edgar Bull, H. B. Hart, Wm. E. Wilmerding, H. H. Man, Chas. J. Berg, C. S. McKune, J. C. Vail, F. C. Elgar, Board of Trustees. Wm. E. Wilmerding, Treasurer. H. B. Hart, West Twenty-ninth Street, New York City, Secretary.

Camera Club of Mount Vernon.—Established 1895. Meetings are held at Studio of W. F. Slaight, Fourth Avenue, Mount Vernon, New York, U.S.A. Miss Mary E. Jennings, Secretary.

Camera Club of the University of Nebraska.—Established 1892. Meetings held at the Chemical Laboratory of the University of Nebraska, corner of Twelfth and R. Streets, Lincoln, Neb., U.S.A. Miss Adaline Quaintance, P. O. Box 675, Lincoln, Neb., U.S.A., Secretary and Treasurer.

Camera Club of the University of Pennsylvania.—Established 1889. Meetings held at the College Hall, University of Pennsylvania, Thirty-sixth Street and Woodland Avenue, Philadelphia, Pa. Chas. R. Hinchman, 3655 Chestnut Street, Philadelphia, Pa., U.S.A., Secretary.

Camerads.—Reorganised April 24, 1890. Meetings held at corner Church and Neilson Streets. Geo. K. Parsell, President. J. Artur Blish, Vice-President. William Macom, D.D.S., James Bradley, Hon. Geo. A. Veighmann, Committee. C. V. Myer, Treasurer. Harvey Iredell, D.D.S., Lock Box 34, Secretary.

Capital Camera Club of Washington, D.C.—Established May, 1891. Meetings held at 1010 F Street. Dr. W. P. Herbst, President. C. E. Fairman, Vice-President. Dr. W. P. Herbst, C. E. Fairman, W. F. Peabody, W. C. Babcock, E. B. Thompson, E. J. Daw, W. S. Davenport, J. W. L. Dillman, H. K. Hickey, W. H. E. Reinecke, Dr. W. E. Dieffenderfer. Misses K. S. Curry, Julia Bullock, R. L. Webster, Board of Directors. W. C. Babcock, Treasurer. W. F. Peabody, Secretary. Miss K. S. Curry, Corresponding Secretary.

Central Camera Club, Brooklyn Y.M.C.A.—Established January 1, 1888. Meetings held at 502 Fulton Street, Brooklyn, N.Y. William H. Lowery, President. James P. Allen, Vice-President. Charles Kuhn, Treasurer. Rud, Gebeth, 19 Hudson Ave., Brooklyn, N.Y., Secretary.

Chautauqua Photographic Exchange Club.—Established 1888. C. M. Fitgerald (Georgetown, California), President. Miss C. L. Pierce, Elmhurst, Riverside, Conn., U.S.A., Secretary and Treasurer.

Chicago Society of Amateur Photographers.—Established December 1886. Meetings held at the Art Institute, Chicago, Illinois. Wm. P, Gunthorp, President. Roscoe R. Gilkey, Vice-President. Dr. Frederick Detlefsen, T. M. Glenn, Robert E. Weeks, D. H. Brookins, and W. J. Karner, Directors. Herman C. Knoke, Treasurer. E. W. Thomas, 10230 Lowe Avenue, Chicago, Illinois, Secretary.

Cleveland (Ohio) Camera Club.—Established January 25, 1887. Meetings held at 5 Euclid Avenue on the first and third Tuesday evenings of each month at Eight p.m. The Annual Meeting is held on the first Tuesday evening in January, unless that Tuesday is the 1st of January, in which case it is deferred until the third Tuesday. William Ogler, President. Charles Potter, Vice-President. William Dorn, Treasurer. R. Dayton, M.D., 1202 Willison Avenue, Cleveland, Ohio, U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Colorado Camera Club.—October 26, 1891. Meetings held at the Club Rooms, 1230 Sixteenth Street, Denver, Colorado, U.S.A. Captain H. D. Smith, President. George L. Beam, Vice-President. Captain H. D. Smith, Thos. A. Morgan, C. A. Yont, C. F. Reed, Geo. A. Green, Major Wm. Cooke Daniels, Geo. L. Beam, Board of Directors. George A. Green, Treasurer. George L. Beam, 1230 Sixteenth Street, Denver, Colorado, U.S.A.

Columbia College (N. Y.) Amateur Photographic Society.—Established 1886. Meetings held at Columbia College twice a month. Henry R. Taylor, President. Dwight Taylor, Treasnrer. H. M. Brookfield, Secretary.

Columbian College (Washington, D.C.) Camera Club.—Established 1888. Ordinary Meetings at Columbian College, Washington, D.C., every Wednesday afternoon. Allan J. Houghton, President. Edwin W. Ashford. Vice-President. W. B Asmussen, Librarian. A. J. Houghton, Treasurer. Charles P. Spooner, Secretary.

Columbia Photographic Society.—Organised 1889, Incorporated 1894. Meetings held at 1811 North Broad Street, Philadelphia, Pa., U.S.A. Dr. G. J. R. Miller, President. Frank D. Long, and J. H. Wallace, Vice-Presidents. Chas. H. Smith, W. T. Innes, jun., E. R. Schmidt, Cabell Trueman, Charles P. Dubbs, Daniel Baker, H. Folwell, H. Sergeson, jun., Board of Directors. Ed. Ramsey, Treasurer. Harry August Vossen, 1024 North Lawrence Street, Secretary.

Columbus (Ohio) Camera Club.—Established October 6, 1884. Rooms Y.M.C.A. Building. Regular Meetings, third Thursday of each month except July and August at half-past Seven p.m. Annual Meeting, third Thursday of December. John Field, President. C. H. Doty, Vice-President. C. S. Bradley, Treasurer. W. B. Kimball, 32 East Spring Street, Columbus, Ohio, U.S.A., Secretary.

Corliss Art and Camera Club.—Established May 1, 1896. Meetings held at the State Street Corliss Memorial Building. J. S. McDaid, President. O. P. Gould and J. H. Wheeler, Vice-Presidents. Edgar F. Noyes, Treasurer. Miss A. B. Brown, Newburyport, Mass., c/o N. N. Jones, Secretary.

Cortland Camera Club.—Established 1895. Meetings held at Y.M.C.A. Rooms. L. M. Alexander, Lock Box 213, Cortland, N.Y., U.S.A., Secretary and Treasurer.

Delaware Camera Club.—Establised 1891. Headquarters in its Club Rooms in the Equitable Building, Wilmington, Delaware. Regular Meetings are held on the first Thursday of each month. John M. Rogers. President. Miss Rachel S. Howland and Geo. A. Elliott, Vice-Presidents, John C. Phillips, 803 Franklin Street, Wilmington, Del., U.S.A., Secretary.

Detroit Camera Club.—Established February 17, 1897. Meetings held at 106 Miami Avenue. E. W. Sprague, President. A. D. Noble, jun., Vice-President. E. D. Roberts, O'Brien Atkinson, R. A. Field, J. E. Scott, F. B. Wood, A. D. Noble, W. S. Thomas, E. W. Sprague, W. E. Winckler. Miss Davidson, Executive Committee. W. E. Winckler, 106 Miami Avenue, Secretary and Treasurer.

Detroit Lantern Club.—Established January, 1891. Meetings held at the Museum of Art, Hastings Street and Jefferson Avenue, Detroit, Mich. Frank E. Kirby, President. A. D. Noble, jun., Director. D. Farrand Henry, 52 Woodward Avenue, Detroit, Mich., U.S.A., Secretary and Treasurer.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Elizabeth Camera Club.—Established 1893. Meetings held at 96 Broad Street. Jas. A. Knowles, President. A. P. Campbell, Vice-President. Dr. E. D. Frost, T. F. McCarty, J. G. Green, John Ball, E. W Smith, A. P. Campbell, A. N. Lakens, Committee. James A. Knowles, Treasurer. John Ball, 96 Broad Street, Elizabeth, N.J., U.S.A., Secretary.

Frankford Camera Club of Philadelphia.—Established October, 1889. Meetings are held at Might's Institute, Frankford, Philadelphia, Pa. Mr. F. K. Miller, President. Mr. Wm. R. Miller, Vice-President. Mr. Wm. R. Miller (Chairman), Miss M. C. Shallcross, Mr. Wm. D. Whitaker, Mr. Alexander Christian, Mr. R P. Summers, Committee. Mr. Alexander Christian, Treasurer. Mr. T. Everett Ford, 4442 Paul Street, Frankford, Pa., U.S.A., Secretary.

Harvard Camera Club.—Established 1889. Headquarters, Harvard University, Cambridge, Mass. Annual Meeting, June. Meetings monthly. Vernon Maunse, President. C. P. M. Rumford, Vice-President. Percy Emerson Brown, 11 Weld Hall, Cambridge, Mass., U.S.A., Secretary and Treasurer.

Haverhill Camera Club.—Established February, 1898. Meetings held at Rooms 44 and 45 Daggett Buildings, Haverhill, Mass. Wm. H. Burke, President. Arthur S. Bailey, Vice-President. Alexander D. Smith, Clarence W. Putnam, and Officers, Committee. George J. Kaula, 97 Memmack Street, Haverhill, Mass., U.S.A., Treasurer and Secretary.

Hoboken Camera Club.—Established March 22, 1889. The Regular Meetings of the Club take place the first Tuesday of each month. The Board of Governors meet the third Friday of each month. The Annual Meeting of the Club takes place the first Tuesday in March, when the election of officers takes place for the ensuing year. All Meetings are held at 1036 Park Avenue, Hoboken, N.J. A. J. Thomas, President. C. Sudhaus, Vice-President. Three Trustees (W. Schrader, A. Beyer, E. E. Wooley), all the Officers of the Club, the House Committee (F. A. Muench), and the Entertainment Committee, Board of Governors. William Allen, Custodian. H. J. Kultenbach, Treasurer. A. L. Smith, 1045 Bloomfield Street, Hoboken, N.J., U.S.A., Secretary.

International Photographic Print Exchange.—Established May, 1893. A Postal Photographic Club of twenty members. Walter Sprange, Beach Bluff Hall, Swamp Scott, Mass., U.S.A., Secretary.

Irvington (N.J) Art and Camera Club.—Established 1892. Meetings are held at Springfield and Union Avenues, Irvington, N.J., U.S.A. Edwin D. Harrison, President. F. H. Morrell, Vice-President. James Peckwell, jun., Treasurer. Melton Tompkins, Secretary.

Lancaster Camera Club.—Established May 3, 1895. Meetings held at Lancaster, Pa., U.S.A. Wm. S. Gleim, President. Wm. A. Heitshu, Vice-President. Charles A. Sauber, 221 South Queen Street, Lancaster, Pa., Secretary and Treasurer. F. A. Demuth, 114 East King Street, Lancaster, Pa., Corresponding Secretary.

Louisville Camera Club.—Established 1888. Meetings held at North-east corner of Fourth Avenue and Jefferson Street, Louisville, Ky. R. L. Stevens, 1100 West Main Street, Louisville, Ky., U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Lynn Camera Club.—Established January 1, 1888. Incorporated December 20, 1889. Regular Meetings, first Tuesday in each month. Annual Meeting, first Tuesday in January. All Meetings held at the Club House, 42 Broad Street. William H. Drew, President. J. N. Smith, Vice-President. W. H. Drew, J. N. Smith, J. W. Gibboney, A. J. Purinton, E. F. Bacheller A. H. Carsley, W. B. Gifford, W. A. Pevear, Committee. E. F. Bacheller, Treasurer. C. A. Lawrence, Club Honse, 42 Broad Street, Lynn, Mass., U.S.A., Secretary.

Memphis Camera Club.—Established 1893. Meetings held at the Y.M.C.A. Buildings. S. J. Latta, President. A. Wardle, Vice-President. S. J. Latta, A. Wardle, Geo. O. Friedel, M. Stewart, E. I. Pinnel, Directors. Geo. O. Friedel, 165 Gayoso Street, Memphis, Tenn., U.S.A., Secretary and Treasurer.

Minneapolis Camera Club.—Incorporated 1892. Meetings held at the Public Library. H. E. Murdock, President. F. V. Haven, Vice-President. President, Vice-President, Treasurer, Secretary, Oscar Tucker, Geo. W. Beach, A. S. Williams, L. J. Skinner, H. E. Peck, E. J. Kimball, Board of Directors. C. F. Potter, jun., Treasurer. C. J. Hibbard, 323 Hennepin Avenue, Minneapolis, Minn., Secretary.

Mystic Camera Club.—Established June 4, 1889. Meetings held at 2 Ashland Street, Medford, Mass. John F. Wade, President. L. E. Shattuck, Vice-President. J. F. Wade, L. E. Shattuck, Everett Scammon, Chas. A. Clark, Edward B. Dennison, J. F. W. Ames, Will C. Eddy, Committee. Charles A. Clark, Treasurer. Will C. Eddy, 18 Summer Street, Medford, Mass., Secretary.

Newark (Delaware) Camera Club.—Established 1893. Meetings held at Newark, Delaware. Professor F. D. Chester, President. G. H. Powell, Vice-President. F. W. Curtis, Newark, Delaware, U.S.A., Secretary and Treasurer.

New Britain Camera Club.—Establised 1892. Headquarters, 210 Main Sireet. Annual Meeting, January. Meetings, second and fourth Tuesdays in each month. E. F. Porter, President. G. A. Reckard, Vice-President. F. W. Wood, 273 Main Street, New Britain, Conn., U.S.A., Secretary and Treasurer.

New England Lantern Slide Exchange.—Established 1890. Will C. Eddy, 88 Marshall Street, Medford, Mass., U.S.A., Secretary.

New Orleans Camera Club.—Established December 17, 1886. Meetings are held at 712 Union Street, New Orleans, La. Hon. Bernard C. Shields, President. W. Gowland, Vice-President. William Grimshaw, Treasurer. M. V. Haulard, 1729 Bienville Avenue, New Orleans, La., U.S.A., Secretary.

Newton Camera Club.—Established 1893. Meetings held at the Club House Brookside Avenue, Newtonville, Mass., U.S.A. F. O. Stanley, President. E. E. Snyder, Vice-President. Austin S. Kilburn, West Newton, Mass., U.S.A., Secretary.

Norwalk Camera Club.—Established November 3, 1897. Mrs. W. V. Prinliss Dingen, President. H. W. Van Sciver, Vice-President. Harry Hall Finch, Bayview Avenue, So. Norwalk, Conn., U.S.A., Secretary and Treasurer.

Old Colony (Rockland, Mass.) Camera Club.—Established February 1, 1890. Meetings held at Arnold Building, Liberty Street. David Smith, President. Emery H. Jenkins, Vice-President and Treasurer. David Smith, Rockland, Mass., U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Omaha Camera Club.—Established 1894. Meetings held at 1312 Farnam Street, Omaha, Neb. W. Durnall, 1312 Farnham Street, Omaha, Neb., U.S.A., Secretary.

Oneida Camera Club.—Established March 1, 1894. Meetings are held at the Club Rooms, Post-office Building, Oneida, N.Y. B. S. Teale, President. George R. Hanson, Vice-President. Jacob Standt, Wesley Fisher, C. M. Kingsbury, Committee. Albert Dygert, Treasurer. C. R. Baker, P.O. Block, Oneida, N.Y., U.S.A., Secretary.

Orange (N.J.) Camera Club.—Organised March 21, 1892. Meetings held on 5th and 20th of each month. F. J. Gould, President. D. S. Plumb, Vice-President. W. H. Cheney, Chairman of Lantern Slide Committee. E. J. Apgar, Chairman of House Committee. F. L. Fieger, Chairman of Membership Committee. T. J. Preston, jun., Chairman of Print Committee. Hermann Joerns, Chairman of Finance Committee. E. S. Butterfield, Treasurer. W. H. Mason, Secretary. Executive Committee composed of above nine persons.

Oregon Camera Club.—Established January 14, 1895. Meetings held at the Club Rooms, Oregonian Building, Portland, Oregon. Will H. Walker, President. F. C. Cover, Vice-President. Will. H. Walker, F. C. Cover, Milton P. Goldsmith, F. A. French, Hugo B. Goldsmith, Executive Committee. F. A. French, Treasurer. Milton P. Goldsmith, P.O. Box 93, Portland, Oregon, U.S.A., Secretary.

Paterson Camera Club.—Established 1893. Meetings are held at 9 Lake Street. C. M. Giles, President. H. W. Gledhill, Vice-President. Wm. M. Moore, Treasurer. Chas. D. Cooke, Cooke Locomotive Works, Paterson, N.J., U.S.A., Secretary.

Photographers' Association of America.—Established 1880. Meetings held at St. Louis, Mo. C. R. Reeves, Anderson, Ind., President. Chas. Hearn, Vice-President. The combined Officers form the Executive Board. F. R. Barrows, Treasurer. George G. Holloway, Terre Haute, Ind., U.S.A. Secretary.

Photographers' Association of Iowa.—Established 1889. Meetings held at Des Moines, Iowa. G. S. Coman, President. E. S. Frey, First Vice-President. W. H. Jacobs, Second Vice-President. Theo. A. Brown, Treasurer. J. R. Hall, Monroe, Iowa, U.S.A., Secretary.

Photographers' Association of Ohio.—Office of Executive Committee, Hamilton, Ohio. A. L. Bowersox, President. George H. Barnum, Springfield, Ohio, U.S.A., Secretary.

Photographers' Association, State of Missouri.—Established 1894. Meetings held at St. Louis, Mo., 1899. George W. Curtiss, President. F. Tenby, jun., and C. Stewart, Vice-Presidents. Miss Belle Johnson, Treasurer Fred. Hammer, jun., 1545 Broadway. St. Louis, Mo., Secretary.

Photographic Club of Baltimore City.—Established 1885. Meetings held at 870 Linden Avenue, Baltimore, Md., U.S.A. Percy M. Reese, President. Charles A. Muller, Vice-President. Percy M. Reese, A. Morris Tyon, James F. Ferguson, Charles A. Muller, E. M. Barker, James W. Bowers, jun., A. Marshall Elliott, Dr. William A. Montell, Edward F. Olmstead, Board of Directors. E. M. Barker, Treasurer. James W. Bowers, jun., 870 Linden Avenue, Baltimore, Md., U.S.A , Secretary.

Photographic Section of the Hartford Scientific Society.—Established February 18, 1885. Meetings held at 803 Main Street, Hartford, Conn. Professor A. L. Gillett, President. Professor A. L. Gillett, Eugene D. Field Chas. S. Blake, Herbert O. Warner, Ernest J. Hoskins, Committee. Chas. S. Blake, Treasurer. Eugene D. Field, 200 Beacon Street, Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Photographic Society of Philadelphia.—Organised November, 1862, Incorporated April, 1885. Meetings held at 1722 Arch Street. Philadelphia, Pa. Walter P. Stokes, President. Samuel Sartain and Anthony W. Robinson, Vice-Presidents. Arthur N. Leeds, Treasurer. George Donchower, 905 Commonwealth Trust Building, Philadelphia, Secretary. Board of Directors includes the above officers and the following members—Prescott Adamson, Henry P. Baily, Clarence B. Bishop, Henry Tatnall Brown, Joseph H. Burroughs, S. Hudson Chapman, Howard W. DuBois, Charles E. Frick, A. Sydney Logan, Charles R. Pancoast, Wm. S. Vaux, jun., H. B. Weymer.

Pittsburg Amateur Photographers' Society.—Organised 1885. Incorporated 1896. Meetings held at the Carnegie Library, Pittsburg, Pa., U.S A. E. E. Keller, President. H. L. Christy, Vice-President. E. E. Keller, H. L. Christy, Mrs. S. A. Ammon, W. J. Boston, F. E. Gaither, F. T. Aschman, A. B. McVay, W. J. Hunker, J. H. Hunter, Board of Trustees. W. J. Hunker, Treasurer. J. H. Hunter, 520 Greene Street, Pittsburg, Pa., U.S.A., Secretary.

Pittsfield Camera Club.—Established 1890. C. G. Tompkins, President. Jas. F. Middleton, Vice-President. J. H. Musgrove, Treasurer. J. E. Colton, Pittsfield, Mass., U.S.A., Secretary.

Plainfield Camera Club.—Established 1889. Meetings held at the Club Gallery, Babcock Building, Walter H. Freeman, President. J. Hervey Doane, Vice-President. W. H. Freeman, Hervey Doane, H. H. Coward, Harold Serrell, George H. Fountain, Board of Directors. H. H. Coward, City National Bank, Plainfield, N.J., Secretary and Treasurer.

Portland (Maine) Camera Club.—Established 1891. Meetings held at the Club Rooms. Stanley P. Warren, M.D., President. C. T. Whipple, Treasurer. Frederick Fox, jun., 66 Union Street, Portland, Maine, U.S.A., Secretary.

Postal Photographic Club.—Established December, 1888. Charles E. Fairman (Washington, D.C.), President. G. A. Brandt, 631 Maryland Avenue, S.W., Washington, D.C., Treasurer and Secretary.

Providence Camera Club.—Organised 1883. Incorporated 1889. Meetings held at 174 Weybosset Street, Providence, R.I. Christopher M. Lee, President. W. Penn Mather, Vice-President. O. L. Holt, Franklin W. Cummings, Frederick E. Brown, Mrs. E. E. Hill, John W. Auty, Arthur Winsor, R. Clyde L'Amoureux, D. Howard Thornton, Executive Committee. Edmund A. Darling, Treasurer. David Bangs Pike, Court House, Providence, R.I., Corresponding Secretary.

Putnam (Conn.) Camera Club.—Established January, 1883. Headquarters at its Club Rooms, Putnam, Connecticut. Regular Meetings are held on the first Friday in each month. The Annual Field Day occurs on the first Wednesday in June. George E. Dresser, President. Edward F. Whitmore, Treasurer. Eric H. Johnson, Putnam, Connecticut, U.S.A., Secretary.

Rutland Camera Club.—Established October, 1893. Meetings held at 149 South Main Street, Rutland, Vt. Cornele G. Ross, President. Cornele G. Ross, N. S. Marshall, V. F. Worcester, Committee. V. F. Worcester 149 South Main Street, Rutland, Vt., Secretary and Treasurer.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Sacramento Camera Club.—Established 1895. Meetings held at the Club Rooms, 504 J Street. Ferdinand Kohler, President. S. B. Nourse, Vice-President. Ferdinand Kohler, S. B. Nourse, W. G. Woods, R. P. Burr, R. B. Prideaux, W. E. Cogswell, J. J. Gormley, Directors. R. P. Burr, Treasurer. W. G. Woods, 420 J Street, Sacramento, California, Secretary.

San Diego Camera Club. Established April, 1900. Meetings held at Sefton Block. Ford A. Carpenter, President. J. E. Slocum, Vice-President. Officers of Club, Committee. Professor F. W. Kelsey, Treasurer. E. L. Rector, San Diego, California, Secretary.

Schuylkill Camera Club.—Established July 5, 1889. Meetings are held at the Q.O.O.F. Hall, 103 Market Street, Pottsville, Pa. A. W. Sheafer, President. Miss Elena Roads, Vice-President. The Officers are the Committee. W. L. Sheafer, Treasurer. B. S. Simonds 1432 West Norwegian Street, Pottsville, Pa., Secretary.

Springfield Camera Club—.Meetings held at the Y.M.C.A. Building. J. D. Roscoe, President. Philip W. Lee, N. D. Copeland, House Committee. John W. Roberts, Springfield, Mass., Box 1016, Secretary.

Stevens (*Hoboken, N.J.*) *Photographic Society.*—Established 1880. Meetings held at the Stevens Institute, Hoboken, N.J. R. P. Jennings, President. — Ode, Vice-President. L. M. De Azeveda and Jos. Stehlin, Committee. Charles L. Wachter, Treasurer. E. C. Voorhees, Stevens Institute, Hoboken, N.J., U.S.A., Secretary.

St. Louis Photographic Society.—Established December, 1895. Meetings held in Y.M.C.A. Building, Grand and Franklin Avenue. Robert E. M. Bain, President. John B. Holman, Vice-President. Charles M. Alexander. 4028 Westminster Place, St. Louis, Missouri, U.S.A., Secretary and Treasurer.

St. Paul Camera Club.—Established May, 1899. W. Almont Gates, President. F. M. Saraway, Vice-President. B. J. Shipman, George S. Wilson, H. A. Adams, Trustees. J. W. G. Dunn, Treasurer. H. A. Seppen, N. P. Railway Building, St. Paul, Minn., Secretary.

Sunny Side Camera Club.—Established October 10, 1891. Meetings held at 5900 South Broadway, St. Louis, Mo. Berthold W. B. Blumenthal, President. Edmund Broch, Vice-President. B. W. B. Blumenthal, William A. Britchner, Charles Hendemuth, Algernon Blumenthal, Committee. William A. Britchner, 1235 South Broadway, St. Louis, Mo., U.S.A., Secretary and Treasurer.

Syracuse Camera Club.—Established 1886. Meetings held at University Buildings. Syracuse, N.Y. Professor F. L. Mead, President. Dan H. Sweet, Vice-President. F. L. Mead, Dan H. Sweet, E. D. Foote, J. E. Bierhardt, H. A. Snellgrove, Fred Rogers, J. H. Wilson, Geo. W. Standen, Board of Directors. J. E. Bierhardt, Treasurer. E. D. Foote, 441 O. C. S., Bank Buildings, Syracuse, N.Y., Secretary.

Tech Camera Club.—Established September, 1889. Meetings, bi-monthly, at half-past seven, p.m., in the Boynton Hall of the Polytechnic Institute, Worcester, Mass. Dark room and Printing room also at Boynton Hall. The purpose of the Meetings is to discuss photographic subjects and, as far as possible, to diffuse a knowledge of the science and art among the members of the Institute. The Executive Committee transact all business connected with the Club. H. J. Fuller, President. A. J. Smith, Vice-President. J. W. Higgins, 228 West Street, Worcester, Mass., U.S.A., Secretary and Treasurer.

AMERICAN PHOTOGRAPHIC SOCIETIES—*continued.*

Technology Photographic Society.—Established 1893. Meetings are held at Massachusetts Institute of Technology, Boylston Street, Boston, Mass. Herman A. Poppenhusen, President. Welles M. Partridge, Vice-President. President, Vice-President, Secretary, Treasurer, Frederick Kleinschmidt, Committee. Arthur C. Lawley, Treasurer. E. Johnson Loring, Mass. Inst. Tech., Boston, Mass., U.S.A., Secretary.

Trenton Photographic Society.—Established January 1898. Meetings held at Room 11, Scott Building, 132 East State Street, N.J., U.S.A. Jas. I. Woolverton, D.D.S., President. Mr. Oscar Woodworth, Vice-President. All Officers and three Trustees, viz., Jno. S. Neary, Gilbert T. Jaques, and Charles F. Albertson. William C. Lawrence, Treasurer. Grant Castner, 329 Tyler Street, Trenton, N.J., U.S.A., Secretary.

Valley Camera Club.—Established 1896.—Meetings are held at Phœnix, Rhode Island, U.S.A. Ward E. Smith, President. Ward E. Smith, Frederick J. Hoxie, Charles T. Howard, Arthur Douglas, Executive Committee. Frederick J. Hoxie, Treasurer. J. Bancroft Lawton, Phœnix, Rhode Island, U.S.A., Secretary.

Waterbury Photographic Society.—Established 1888. Meetings are held at Platt's Block, Waterbury, Conn. Oscar A. Ziglatzki, President. George F. Hodges, Vice-President. Henry T. Stedman, George H. Ward, George Husker, Executive Committee. Henry T. Stedman, Treasurer. Hollyday Emery, Waterbury, Conn., U.S.A., Secretary.

Watertown (N.Y.) Camera Club.—Meetings held at 4 Paddock Arcade, Watertown, N.Y. A. R. Wilson, President. George Mowe, Treasurer. C. A. Wilson, 2½ Public Square, Watertown, N.Y., U.S.A., Secretary.

Worcester Camera Club.—Re-established 1892. Meetings held at Walker Building, 405 Main Street, Worcester, Mass. Daniel F. Gay, 214 Main Street, Worcester, Mass., U.S.A., Secretary.

Young Women's Camera Club.—Established November, 1894. Meetings held at the Young Women's Christian Association Rooms, Minneapolis, Minn. Miss Mabel Jameson, President. Miss M. Bells Jeffery, Vice-President. Miss Minesoa Turnbull, Treasurer. Miss M. Eva McIntyre, 1833 Portland Avenue, Minneapolis, Minn., U.S.A., Secretary.

POSTAL INFORMATION.

INLAND LETTERS.

The rates for Inland Letters are as follows:—

4 ozs.	1d.	10 ozs.	2½d.	16 ozs.	4d.
6 ozs.	1½d.	12 ozs.	3d.	18 ozs.	4½d.
8 ozs.	2d.	14 ozs.	3½d.	20 ozs.	5d.

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Single letters not exceeding 4ozs. in weight can be sent by railway. The postage and a fee of 2d. must be paid to the railway servant receiving such letter, and he will affix and obliterate a special label. Such letters must be taken to a passenger station, and will be sent to destination by first available train. They may be addressed to the Parcel Office at the station of destination "to be called for," or, if so desired, will be posted in the nearest Post Office to the station to which addressed for delivery by ordinary post.

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The ordinary postal rate on newspapers is a halfpenny for every 2 ozs.; but publications which consist wholly or in part of news, or articles on current topics, and which are printed and published in the United Kingdom at intervals of not more than seven days, may—for an annual fee of 5s.—be registered for transmission by post in the United Kingdom at the newspaper rate of a halfpenny each, irrespective of weight. The full title and date of publication must be printed at the top of first page, and the date and part or all of the title on every other page. No newspaper packet may be above 5lbs. in weight, 24 in. long, 12 in. wide, or 12 in. deep. Registered newspapers must be so folded that the title may easily be read, and must be posted either without a cover, or in one open at the ends, so as to admit of easy removal for examination. Nothing of the nature of a letter may be written on the newspaper or its cover, except a reference to any part of such paper.

NEWSPAPER WRAPPERS.—Halfpenny stamp, ¾d. each, 7 for 4d. or 22s. 10d. per 480. Penny stamp, 1¼d. each; 8 for 8½d., or 21s. 3d. per 240. Sheets of halfpenny wrappers may be obtained at 2 days' notice in packets of 120 sheets of 14 wrappers each at £3 18s.

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Except in regard to 2-oz. packets, which may still be sent for a half-penny, the Book-Post is practically abolished, all packets over 2 ozs. being subject to the same rates and regulations as Letters (which see).

A 2-oz. Book Packet may contain any matter wholly printed on paper, or other substance in ordinary use for printing; books or literary publications, sketches, drawings, paintings, maps, plans, etc.; invoices, advice notes, bills of lading, and similar commercial and legal documents, provided that nothing is written on them in the nature of a letter, or other entries proper to such documents; proofs or manuscripts for press, and examination papers under similar conditions, and circulars or printed notices. The circular may be altered in writing, and, in the case of notices of meeting, the place, hour, date, and objects may also be inserted. (The word "printed" is intended to cover only forms produced in numbers by ordinary mechanical means; imitation type-written circulars are included if in identical terms and in numbers of not less than 20 specially handed over the counter at a Post Office and attention called to their nature.) A Book Packet may be posted either without a cover or in one open at both ends, so as to admit of easy withdrawal for examination. The ends may be secured with string, but stamps may not be fixed partly to the wrapper, and partly on the publication.

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1 lb.	3d.	5 lbs.... ...	7d.	9 lbs.... ...	0s. 11d.
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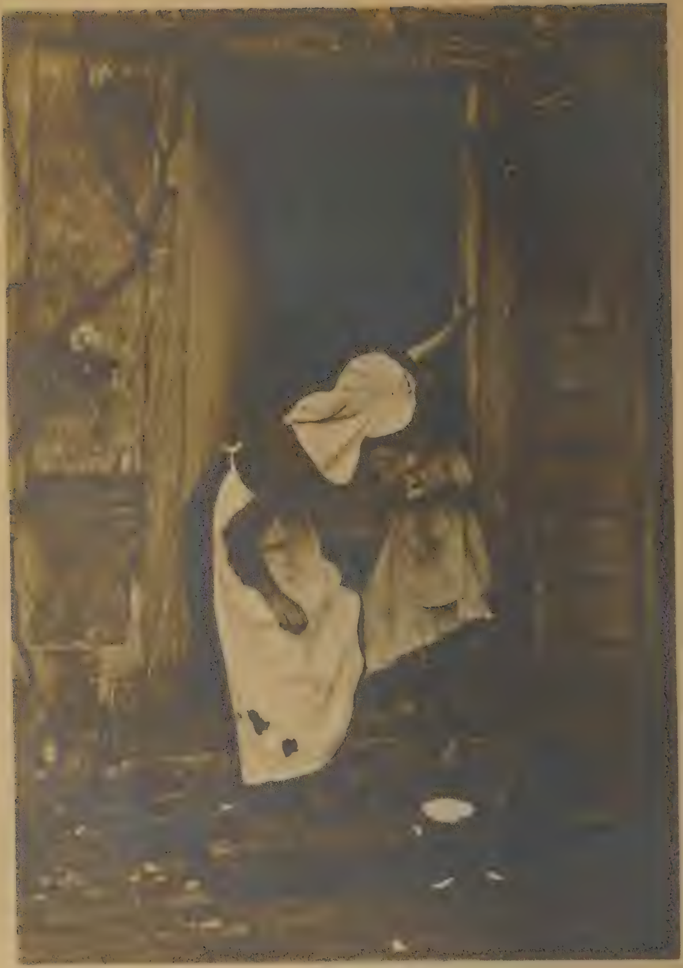


By J. B. B. WELLINGTON

"THE BROKEN SAUCER."

PRINTED ON "Wellington" BROMIDE (Platino-Matt.)
SMOOTH.

SUMMARY.

Like most branches of British industry in 1903, photography has continued to experience the effects of that depression which commenced to manifest itself immediately after the conclusion of the South African War, and the unprecedentedly bad weather of the year has also been an adverse factor. Still, it is pleasant to perceive unmistakable signs of inventive and manufacturing activity, which augur favourably for the progress of photography in popular esteem. The photographic postcard attained in 1903 a truly remarkable vogue, and the production of these small souvenirs has been so enormous as to justify the belief that they form the media of a great and successful department of the trade.

Another marked feature of 1903 has been the introduction of new sensitive plates, papers, and roll films in almost bewildering variety. In respect of plates, several makers seem to have succeeded in securing a degree of rapidity not hitherto attainable, and which has been found of great advantage by practical workers, who at one time were wont to associate maximum speed with difficulty in avoiding fog in development.

In camera construction there has been a growing tendency to facilitate the use of cut films, and it is probable, from the information at hand, that we shall witness in 1904 and 1905 great efforts on the part of the principal manufacturers to push special cameras and changing systems wherein films of this nature are to be employed.

Interesting modifications of the application of trichromatics to paper are due to Mr. Sanger Shepherd and to Dr. Jumeaux and Captain Lascelles Davidson; and public interest in the use of the cinematograph for recording natural history life and movement has undoubtedly been excited. But on all sides one hears regret expressed that the optical lantern as an educative agency no longer enjoys its former supremacy.

The most notable optical achievement of the year is, perhaps, to be credited to Dr. Moritz von Rohr, who has produced oculars for the stereoscope which enable two identical prints from one small negative to present, on examination, the effect of apparent solidity. Dr. von Rohr's descriptive paper is not yet accessible in full, but the practical value of his work will at once be recognised by those having an acquaintance with the theory of binocular photography.

OBITUARY OF THE YEAR.

AMONGST the specially prominent photographers who have died since the publication of the last ALMANAC, the following may be mentioned :

- Sir George Gabriel Stokes.
- J. J. Elliott.
- Edward L. Wilson.
- Washington Teasdale.
- A. R. Dresser.
- Dr. A. A. Common.
- A. T. Ward.

Sir George Gabriel Stokes,

Master of Pembroke College, Cambridge, Lucasian Professor of Mathematics, formerly President of the Royal Society, sometime member of Parliament for the University, died on February 8th, at his residence, Lensfield, Cambridge. He was born at Skeen, county Sligo, on August 13, 1819. His parents were the Rev. Gabriel Stokes, rector of Skreen, and Elizabeth, daughter of the Rev. John Haughton, rector of Kilrea. He was educated at Dr. Wall's School, Dublin, and at Bristol College. Subsequently he proceeded to Pembroke College, Cambridge, where he graduated as Senior Wrangler in 1841 (Dr. Cayley, his rival in mathematical eminence, was Senior Wrangler in 1842), and was elected to a Fellowship, which he vacated on his marriage in 1857, but to which he was re-elected under the new statute in 1869. He was appointed Lucasian Professor of Mathematics in the University in 1849, and was elected a member of the Royal Society in 1851. In the following year he was awarded the Rumford medal in recognition of investigations regarding the refrangibility of light ("Philosophical Transactions, 1852"). He was appointed one of the secretaries of the society in 1854, and, after numerous contributions to the Transactions of that and other learned bodies, he became President of the Royal Society in 1885, a post which he held until 1890. In 1889 he was created a baronet in reward for his services to science, which were freely recognised abroad as well as at home, and brought him, among many other distinctions, the Prussian Order "Pour le Mérite." He received honorary degrees from his own University, from Oxford, Edinburgh, Dublin, Glasgow, and Aberdeen. Sir George presided at the Exeter meeting of the British Association in 1869, and in the following year he was appointed to serve on the Cambridge University Commission.

J. J. Elliott.

Mr. Joseph John Elliott, who was born on October 14th, 1835, and died on March 30th, 1903, was descended from an old Scottish family.

His father, son of a prosperous woollen manufacturer in the West of England, was fired while still at school with the wave of patriotic war fever which passed over England when Napoleon was at the zenith of his career. Three times he ran away and enlisted, and twice his father bought him off, but on the third occasion he grew tired of these escapades, and so he was allowed to take his chance in the 2nd Battalion of Grenadier Guards. It was not long before his regiment was sent to the Peninsular War, where he fought in the battles of Nivelle, Salamanca, and Badajos; later he was present at the battle of Waterloo, where, as one of Wellington's famous Foot Guards, he was severely wounded and left upon the field as dead, remaining for two nights and a day before he was discovered. On returning to England he found that in his absence his father had died, and through undue influence nearly the whole property had been left to an old man servant. These facts will serve to show whence Mr. Elliott inherited his restless and determined character. Born near Croydon, in 1835, the first important step in this active life was the departure of Mr. Elliott at the age of fifteen for Australia. Gold was discovered soon after his arrival, and on three occasions he joined in the general rushes to the diggings, where so many fortunes were made. In 1851 it was to Ballarat, and in 1852 to Mount Alexander and Bendigo, but at neither place did he meet with any sensational success. He also started and worked a stone quarry, and subsequently purchased land, which, with the aid of only one labourer, he cleared and developed himself, living a secluded and primitive life for many months while thus engaged. After many interesting, exciting, and somewhat rough experiences, he returned to England in 1859. For three years he was connected with the Imperial Gas Company in London, when, becoming associated with Mr. Clarence E. Fry (whose sister he afterwards married), they joined in partnership, and took premises at 55, Baker Street. Mr. Fry had acquired a sound and thorough photographic experience with Messrs. Wilson, of Aberdeen, and his technical knowledge and artistic instincts, in conjunction with Mr. Elliott's business capacity, combined to build up what has since become the world-famed establishment of Elliott and Fry. The premises which they took in 1863, owing to the rapid growth of the business, soon proved to be inadequate, and the adjoining house at 56, Baker Street, had to be added. Space forbids more than a passing reference to the important and interesting developments of the business. In 1886 a branch establishment was opened in South Kensington, of which Mr. Fry took the management. It is an interesting fact that the Barnet Company originated in a printing establishment in a small house at New Barnet, which, however, was very soon found to be inadequate, owing to the very rapid development and expansion of the business. Several acres of land were purchased at High Barnet, new printing works were built, and the manufacture of dry plates commenced. It is there that the enormous plate and paper factory has grown up, the result of Mr. Elliott's indomitable will and untiring energy. In 1887 Mr. Elliott acquired Mr. Fry's interest in these works, since which time they have been carried on as a separate concern. In 1893 the partnership, which had so happily existed for thirty years, was mutually dissolved, Mr. Elliott retaining the business at Baker Street, and Mr. Fry that at South Kensington. For pastimes, Mr. Elliott had a passion for travel, and in the intervals of recreation which he took from time to time, he visited every country in Europe; he also knew the Mediterranean from end to end, and had spent many months in Japan, Ceylon, Canada, America, South Africa, and the Holy Land. In art circles he was well known as a collector and connoisseur of pictures, and amongst his art treasures were many valuable examples of the works of Herkomer, Colin Hunter, Edwin Ellis, Aumonier Mesdag, Gow, Mauve, and Van Haanen, whose work he was the first to appreciate and introduce to this country. Mr. Elliott, who is survived by his wife, four sons and three daughters, for many years resided at his beautiful estate at Hadley House, Barnet, where he died. He was a member of the Constitutional Club, the Royal Colonial Institute, the Royal Institution, and the Japan Society, and was ultimately associated with numerous philanthropic and other institutions.

Edward L. Wilson.

Edward L. Wilson, editor and publisher of *Wilson's Photographic Magazine*, New York, and well-known as the author of several standard text-books on photography and Oriental travel, died at Vineland, New Jersey, on June 23rd, and was buried in the little cemetery of that town on Friday, June 26th. By his death American photography loses one of its pioneer workers, who was prominently associated with its progress during the last forty years, and whose whole life was devoted to the practical helping of those who follow photography as a profession.

Edward L. Wilson was born at Flemington, New Jersey, in 1838, and received his education at the local academy. He began his work in photography at Philadelphia in the early sixties, being associated with Mr. Frederick Gutekunst, the veteran portrait photographer of that city. In 1864 he began the publication of the *Philadelphia Photographer*, then the only photographic magazine in America. At that time photography was in a transitional state, hampered by innumerable restrictions and abuses, infested by a class of men who, taking advantage of the little practical information available concerning the early processes, travelled the country over and sold so-called "secret processes" and "rights to use" certain formulæ. Photographers were also struggling under the burden of a stamp tax upon every photograph made, adopted as a means of revenue during the Civil War. The Carbon patent and the photo-lithographic patents were also among the troubles of these early years. These abuses Mr. Wilson from the beginning endeavoured to remedy, and with complete success. His first service was to secure a modification of the Copyright Law of 1831, so as to include photographs. In 1865 he organised and led the opposition of the fraternity to the so-called "Bromide Patent." This fight prevailed during several years, and eventually resulted in the upsetting of the patent, by which decision photographers were freed from a grievous tax. The stamp law was modified in 1866 and completely removed in 1868. In this year Mr. Wilson was foremost among those who organised the National Photographic Association, of which the present Photographers' Association of America is the successor. Of the old N.A.P. Mr. Wilson was the permanent secretary for many years, devoting to its service considerable personal labour and resources. The first exhibition and convention of the Association was held at Boston in June, 1869. Early in this year the photographers united under Mr. Wilson to oppose the issuing of a patent controlling all methods of saving wastes from photographic solutions. The validity of this patent was challenged, and during the progress of the legal battle, which covered a number of years, Mr. Wilson was arrested in New York. Eventually the patent was overthrown, and Mr. Wilson received, at the Cleveland, Ohio, Convention of 1870, the congratulations of the fraternity upon his victory. In 1873 the National Association held at Buffalo, New York, what was probably the most successful photographic gathering ever held in America. A special number of the *Philadelphia Photographer*, comprising some 224 pages, reported this convention in detail, being published within two weeks after the close of the convention—a remarkable journalistic feat at that time.

Immediately following this convention, Mr. Wilson was appointed by the city of Philadelphia as a delegate to visit the Vienna Exposition of 1873, to awaken interest in Europe for the coming Centennial Exposition of 1876, held at Philadelphia. Returning to America, the National Association, through the *Philadelphia Photographer*, organised a movement to secure a separate building for photography at the Centennial Exposition. By Mr. Wilson's personal effort half of the sum necessary was contributed by the Centennial authorities, the other half being gathered by subscription among the fraternity. This resulted in the most wonderful exhibit of photography and its applications yet seen in America. The photographic concession of the exhibition was placed in the hands of Mr. Wilson and the late W. Irving Adams, under the name of the Centennial Photographic Co. This concern employed hundreds of workers, and secured a complete photographic record of the exhibition from its inception to its close. We believe that the British Government is the sole possessor of the complete collection of photographs comprising this notable record of the Exposition, although many of the negatives are now deposited in the Commercial Museum at Philadelphia. Later he also had charge of the photographic department of the Cotton Exposition, held at New Orleans. In 1880 Mr. Wilson issued a special supplement to the *Philadelphia Photographer*, urging the organisation of the new Photographers' Association of America, and calling attention to the promise of the dry-plate being introduced at that time. The presidency of the new organisation was offered to Mr. Wilson, but he declined, stating his resolution to devote the remainder of his life to his work in journalism.

In 1882 he visited the Orient in charge of the largest photographic expedition ever attempted in those countries, visiting and photographing through Egypt, Arabia, and Palestine. Returning to America, he utilised the vast source of pictorial material thus secured in the lecture field and in preparation of articles for the *Century* and *Scribner's Magazine*. His exploration of the buried city of Petra, in Arabia, was recognised by savants as a distinct achievement. In recognition of the value of his work in the East, as supplying lost links in Biblical history, the Washington and Jefferson Universities of Pennsylvania honoured him with the degree of Doctor of Philosophy. The results of his travels were afterwards embodied in a work entitled "In Scripture Lands," wherein the best of his photographs were reproduced by the leading wood engravers of the modern American school.

From the beginning of his work in photography he evinced a wide and enthusiastic interest in the possibilities of the optical lantern as a means of instruction, and did much to make stereoscopic photography popular among the American people. His collection of lantern slides and stereoscopic views of American and European countries was probably the most comprehensive ever brought together in America. During these years the publication of the *Philadelphia Photographer* was continued, and in addition Mr. Wilson undertook the editing and publishing of the *Photographic World* and the *Magic Lantern*, the latter being, we believe, the first periodical devoted to this branch of photography.

In 1885 the name of the *Philadelphia Photographer* was changed to *Wilson's Photographic Magazine*, and the office of publication was removed to New York, where it was published as a semi-monthly, and later as a monthly, magazine. During the years 1881 to 1893 Mr. Wilson wrote and published his well-known text-books on photography, which have enjoyed an unusually large sale in America. Of these Wilson's "Cyclopædic Photography," known to some of our readers, may be mentioned as probably the most comprehensive work on photography in the English language. After the removal of the magazine to New York Mr. Wilson steadily continued his labours as a photographic journalist until his death, recognised by all classes of photographers as one of the fathers of American photography in the truest sense of the phrase. He had an enormous capacity for work, and his various publications willl remain as a monument to his indefatigable ability in photography. A man of high ideals and sterling integrity, he had a lovable personality, and possessed in an unusual degree the faculty of attracting the enthusiastic support of those with, and for, whom he worked during his long life. He leaves a gap which it will be difficult to fill, and his death will be mourned as a personal loss by all who touched his life and work.

Washington Teasdale.

The doyen of Yorkshire scientists, Mr. Teasdale, who died in September, 1902, aged seventy-three, was well known and welcomed wherever men of science most do congregate. He was more than a mere dabbler; in certain branches he was something of an authority. For him science had an absorbing interest, and for the greater part of his life it was almost his sole occupation, and a hobby that gave a joy to existence. From boyhood his mind showed a scientific bent. His father dying before Washington had reached manhood, he and his younger brother and his sister were brought up to some extent under the guardianship of their grandfather, the late Mr. Christopher Heaps, a distinguished Leeds citizen about the middle of the last century. The youth was educated at Mr. Richard Hiley's academy, then a noted school standing near the junction of Queen Square and Woodhouse Lane. His subsequent training fitted him for the career of a civil engineer. Afterwards he went to India in connection with railway development in the Dependency. In India he remained for several years, and such was the mastery that he acquired over the native language that it is said that even up to his death he preserved the habit of thinking in Hindustani. On his return to England he settled in his native town on a moderate competence, which would have been greater but for his mother's losses through the disastrous failure of the Leeds Banking Company in the sixties. With no business responsibility and few domestic ties—his wife died many years ago, and he also lost his only child—he had ample leisure to follow his tastes. His love of science amounted to a passion. His home in Hyde Park Road was a veritable treasure house of scientific apparatii, works of art, interesting curios, and other objects that denoted the wide range of his studies and sympathies. His collection of telescopes, cameras, microscopes, and slides is unique in its way. In every department of study which he took up he made himself acquainted with the best thinkers. He travelled hundreds of miles to meet men of light and leading in the scientific world. He had the entry to the houses of some of the most eminent scientists in London and elsewhere. Start him on a favourite topic, and he would talk by the hour, all unconscious of the claim upon the time of the ordinary man of the world. It was an amiable weakness, and men of learning were always glad to meet with a man so full of enthusiasm. In astronomy and photography he found his chief delights. In photography he was among the pioneers. Before he went to India, when the art was in its infancy, he and a few others founded a photographic society, and he continued his active connection with the successor of that body to the very last. With the development of photography he was in the closest touch, and no new process was introduced that he did not familiarise himself with. His camera was his constant companion, and he hardly ever took a holiday or went on a journey that did not yield a fresh contribution to his collection of views. One of the first, if not the very first, to adopt the modern method of illustrating lectures by means of lantern slides, he lectured hundreds of times in connection with various scientific and literary societies. Astronomy had a strong fascination for him. It is almost literally true to say that his telescope was ever set for observation. As a Fellow of the Royal Astronomical Society and as founder and whilsome President of the Leeds Astronomical Society, he had more than the mere "star-gazer's" interest in "the science of the heavens"; his studies in this direction had a mathematical basis. He was also a Fellow of the Microscopical Society; his varied collection of slides were the envy of many a microscopist.

A. R. Dresser.

Mr. Dresser died on July 28th, at the comparatively early age of fifty-eight. Mr. Dresser was a frequent exhibitor, and was the winner of many medals in the early days of the photographic advance which followed the introduction of the gelatine dry plate, and he was one of the first members of the London Camera Club, where his genial personality will be recalled by many of the older members. Of late years he had been a confirmed invalid, and never left his home at Bexley. Some of Mr. Dresser's marvellous anecdotes are still current at the club, for he was a master of the tallest of tall stories, and used to take a keen delight in testing the credulity of those who do not see a joke too readily. One of these we call to mind. The story was about a relative of his who was shipwrecked, but who managed to swim many miles with a belt, not a life belt, but a receptacle which contained fifty thousand pounds in gold! One of his hearers had the temerity to point out that this amount of bullion would weigh a trifle of half a ton or so. But the narrator of the story, not in the least abashed, remarked that the weight must vary with the barometric pressure and with the latitude, and that he always claimed for his stories a good deal of latitude. He will long be affectionately remembered as a pleasant companion, and one who was an earnest photographic worker. At Bexley Heath he had a studio, dark-room, enlarging-room, and other conveniences to enable him to prosecute the study which he loved so well.

The following note from the pen of Mr. W. A. Greene appeared in the *Camera Club Journal*:—"It is with deep regret that we have to record the death of a firm friend, and a most useful and popular member, in his day, of the Camera Club—Mr. A. R. Dresser. Owing to severe and painful illness, Mr. Dresser was unable for many years past to take part in the proceedings of the club, and to the more recent members his name will probably be unknown. But those who foregathered with the club in its early habitation in Bedford Street, will never forget the striking individuality of their old friend, and the enthusiasm and energy he threw into all that he took up, and especially into his chief and favourite hobby—photography. It was Mr. Dresser who first suggested the formation of the club in a letter to the editor of the *Amateur Photographer* on April 28th, 1885. This brought forth numerous letters from others who agreed that a club was desirable, and a meeting was shortly after held, at which it was resolved that the club should be founded. Mr. Dresser was the first hon. sec., and it was greatly due to his energy that the initial difficulties were overcome, and the club was fairly put upon its legs. After resigning the secretaryship, Mr. Dresser served upon the committee until 1891, when failing health forced him to resign an active part in the conduct of affairs. Mr. Dresser was a most prolific worker, and if his productions did not always come up to the high standard of art set up by "The Salon," he showed many pictures, both at the club rooms and at various exhibitions, which attracted much interest and attention. There are many of us who will always remember his studio and workrooms at Bexley Heath, and the piles upon piles of rejected negatives which attested to his constant work, as well as the rows upon rows of more or less empty bottles which spoke of the avidity with which he seized upon any new process and experimented upon it. These experiments were not always conducted in accordance with the strictest rules of scientific research, and I remember how he used to declare that one of his most successful negatives was developed by a mixture taken at haphazard from a dozen bottles on his shelves. Those who will take the trouble to look up the first volume of "The Proceedings of the Camera Club," to be found on our bookshelves, will see, on page 17, a very amusing paper by Mr. H. H. O'Farrell, styled 'An interview with Mr. Slopley Dishcombe,' and I feel at liberty to refer to this, for no one enjoyed the skit more than our dear old friend, at whose expense it was written. He was of a very kindly nature, and though he could and did speak strongly when he felt there was occasion for doing so, he made many friends and few enemies, and his friendship will always be a pleasant and treasured remembrance to those who were privileged to enjoy it."

Dr. A. A. Common.

Dr. Common, who was born at Newcastle on August 7th, 1841, and died on June 2nd, 1902, was perhaps the most successful constructor of reflecting telescopes of his time. His devotion to astronomical work dates from an early period of his life, and so far back as 1874 he possessed a 5½in. refractor. In 1877 he acquired an 18in. reflector by Calver, but this did not long satisfy him, and he proceeded to construct a still larger instrument. In this the mirror, which was 3ft. in diameter, was made of silvered glass, the use of which had been proposed by Steinheil and Foucault twenty years before, but which had not up to that time been employed on any considerable scale. The first disc of glass that was prepared for the new instrument burst into fragments, but a second was successfully worked and mounted in 1879. Dr. Common paid great attention to the mounting of his telescope, and among the conditions which he insisted should be fulfilled were that there should be no tube properly so called, so as to avoid air currents in the tube; that there should be no mass of metal either below or at the side of the line joining the large and small mirrors, to avoid currents from possible differences of temperature between the mass of metal and the surrounding air; that the mounting should be equatorial, capable of being directed to any part of the visible heavens and of being used for continuous observation past the meridian; that the mirror should be efficiently mounted, to prevent flexure; and that the mounting should be as steady and as free from friction as possible. In erecting this telescope his engineering attainments found full play, and among the features he introduced were the method of reducing the friction of moving parts by floating them on mercury, and special adjustments for photographic purposes. As soon as the telescope was finished, he began to apply it to the photography of nebulæ. His first attempt in 1880 on the nebula in Orion was a failure; but a second in 1882, with more sensitive plates and an improved driving clock, was more successful, and in 1883 he obtained the splendid photograph that won him the gold medal of the Royal Astronomical Society. He also photographed other nebulæ and stars, and his work, by demonstrating that the light from very faint stars—so faint as to be invisible to the eye—exercised a cumulative effect on the photographic plate, so that by continued exposure strong images are formed, opened out a new field of research to astronomical science.

Dr. Common, however, did not remain content with his 3ft. instrument, in spite of the splendid results he obtained with it, but proceeded to undertake the task of making a 5ft. reflector with a focal length of 27½ft. The first mirror for this was finished in 1888, but was rejected because it was found to give elliptical instead of circular star-images. The new mirror, however, ready in 1891, completed an instrument which at that time was unsurpassed for light-concentrating power, since, although it was smaller than Lord Rosse's famous telescope at Parsonstown, which has a 6ft. mirror, the material used was silvered glass, which is more effective than the speculum metal of the latter. Now, however, it has two rivals—the 50in. Paris refractor and the Yerkes 5ft. reflector. The old 3ft. reflector, which was sold to make room for the new 5ft. instrument in Dr. Common's laboratory at Ealing, found its way to Lick Observatory, where it enabled Keeler to obtain his extraordinary results in the discovery of new nebulæ. Among other telescopes in the construction of which Dr. Common had a share may be mentioned the 30in. reflector at Greenwich, and the 3ft. reflector at the Solar Physics Laboratory, South Kensington.

Dr. Common, who of recent years had devoted much attention to improvements in the sighting of guns, was an honorary LL.D. of St. Andrew's. He became a Fellow of the Royal Astronomical Society in 1876, received its gold medal in 1884, and acted as its president in 1895-96. He was chosen a Fellow of the Royal Society in 1885. He leaves a wife, son, and three daughters.

A. T. Ward.

Mr. A. T. Ward for over thirty years carried on a large photographic business at 64, Brixton Road, S.W. The deceased gentleman was well known and highly esteemed in Brixton, Battersea, and Chelsea, where he had established branches of his business. Mr. Ward, who died on September 19th. of cancer, after eight months' painful illness, started in Brixton in 1864.

SOME BY-PATHS OF PHOTOGRAPHIC PRINTING.

By The Editor.

The appended résumé of some of the less known photographic printing processes that have been employed during the past fifty years will, I hope, meet a want which is constantly manifesting itself in the Correspondence columns of the "British Journal of Photography." Working details concerning the platinotype, carbon, albumeno-nitrate, gelatino-chloride and bromide printing processes are nowadays available through many channels of information. The methods themselves enjoy so marked a vogue and popularity, and are the subjects of so much discussion in the pages of the Press and at meetings of photographic societies, that most modern photographers may readily be pardoned for being ignorant of the fact that these stock printing processes, if I may so term them, by no means exhaust the possibilities of printing from the negative. Quite a world of fascination and novelty of manipulation awaits the photographer who cares to leave the beaten track and make practical experiment with some of the methods of printing that were in favour with former generations of photographers.

For most of the information here presented, I have drawn upon the writings of those who have successfully worked the processes described. The outlines of the Artigue, Gum Bichromate, and Ozotype processes, for which I am indebted respectively to Mr. Alfred Maskell, Mr. James Packham, and Mr. Thomas Manley, should be supplemented by reference to the detailed treatises on those methods which are found in a list of the principal text-books on photography that is given in another section of this volume.

CHAPTER I.

Collodion Transfers and Photo-crayons.

Soon after the present Queen came to this country Disderi took a negative of this illustrious lady, *cartes* from which soon found their way to the public, and so great was the demand for these that it was impossible to print them by ordinary means in quantities sufficient to keep pace with the requirement. Very soon, however, there was an issue of them of a type differing from the ordinary class of silver prints. They were very delicate, yet vigorous, of an engraving-black tone, and on enamel paper. I am indebted to the late Mr. J. Traill Taylor for the following details: They were all collodion transfers, and were produced in the following way:—At one end of a copying camera was inserted a negative, at the other end being the dark slide capable of containing a plate of large dimensions, and also capable of being subjected to a series of shifts, both from top to bottom, and from one side to the other. Each shift brought the sensitive plate in front of a square, or rather oblong, aperture, in which was focussed the picture to be printed. Between the negative and the sensitive plate the lens was inserted. The camera was directed upwards to the sky, and to position No. 1 was given an exposure of, say, four or five seconds, according to light. Then a shift of the sliding back was made to position No. 2, followed by a similar exposure, and so on until the twelve or twenty-four (as the case might be) positions were secured.

The images were then developed at one operation by proto-sulphate of iron containing a liberal proportion of acetic acid. After being fixed, they were toned by means of a wash of bichloride of mercury, by which the image was darkened. The collodion film was then well washed, which, it need scarcely be said, occupies a mere modicum of time compared with that required for a gelatine film. While still wet, a sheet of enamelled paper was laid upon the plate, a squeegee passed over its back to ensure contact, and, without waiting till it became dry, the paper was immediately stripped from the glass plate, carrying with it the one or two dozen pictures thereon.

By means of a punching machine the pictures were cut out of the sheet and then mounted without other preparation. In this way were printed hundreds of thousands of pictures, a singular fact being that, notwithstanding the summary and quick treatment to which they were subjected throughout, many of those prints have proved *more permanent* than others printed at the same time on albumenised paper and toned by gold in the most approved method.

Let it be well understood that the mercury treatment must be carried no farther than the blackening of the silver deposit which formed the image, no after-application of ammonia or other alkali being made.

The method here described ought to prove of great value to professional photographers, who are often sadly troubled as to getting orders executed during the prevalence of weather hostile, from its darkness, to printing. M. Disderi, at that time the *bon-ton* photographer, not alone of Paris and London, but of Europe, made no difficulty about permitting his method of printing to be published, and photographers at the present day ought not to be too conservative to avail themselves of his methods. The one objection which might have been urged against these transfers at the time of their introduction, viz., the fear that the British public might object to tones other than the time-honoured photographic purple, now no longer exists, thanks to the educating influences of platina and bromide. On comparing a Disderi print made in our presence by the method just described with one of the most recently produced platina prints, we find a wondrous degree of similarity in their tone.

If negative collodion is about to be made use of in the production of transfers, it should be a tough, horny character, and rather thicker than what is required for small negative work. It should also contain a large proportion of bromide, and, as previously stated, it should give a thin and rather feeble image. This it will in all probability do if about one-fourth its bulk of plain uniodised collodion be added to it.

Large transfers, intended to be painted in oil colours, as those so long associated with club work, are made rather differently from the Disderi method described.

These prints are usually enlarged from small negatives, and may be made either by a limelight lantern or by directing the camera to the sky. If brevity of time of exposure is an object, the development may be done by iron, a strong solution being preferred, but held in check by gelatine and citric acid, this last determining the tone, for without it the print would be too grey and feeble by reflected light. But the finest-looking pictures are produced by pyrogallol, the following formula being one that can be well recommended for the purpose:—

Pyrogallic acid	100	grains.
Citric acid	60	,,
Acetic acid	2	ounces.
Water	20	,,

The tone given by this is dark yet warm-coloured, and is such as not to necessitate any after-toning. The finest tones are obtained when this developer is used within a week of its preparation. After fixing, for which hyposulphite of soda must imperatively be employed, and washing, the picture, it is not allowed to dry, but is covered with a sheet of wet transfer paper, which is squeegeed in contact, and the whole reared up to dry, which it will do in the course of a night. Next morning it is stripped from off the glass plate, and is found with an extremely glossy surface, favourable for the application of oil colours. If it is not to be thus painted, a more matt surface is better, and this is obtained, either by stripping off the paper before it is allowed to dry, or, if dry, by steeping in water.

The transfer paper is easily made, and each photographer can prepare it for himself—a large quantity at a time, for it keeps for an indefinite period. Any good paper is floated upon gelatine prepared thus:—Place four ounces of gelatine in a quart of water, and allow to soak for half an hour, then warm the vessel by placing it in a second one containing hot water. The gelatine will now become liquefied, when four grains of chrome alum, previously dissolved in hot water, are added. This is poured into a flat dish, and retained in a fluid state by the application of gentle heat. The paper is coated by being floated upon this, and a quantity should be done at a time, for the paper will keep, but the gelatine will not.

When this transfer paper is about to be used, it must be soaked in cold water for a few minutes, when the coated surface will have a slimy feeling. It is then laid face down upon the picture as already described.

Concerning photo-crayons little need be said. A thin transparency produced as described is dried upon the glass, and is backed with paper of any desired colour or texture. The specific name is derived from its productions being vignettes, and the backing paper having pencil hatching, *à la* crayon, merging into the photograph.

CHAPTER II.

The Ivorytype.

This style of photograph was of American invention and introduction. It bore a very close resemblance to an ivory miniature, from which it derived its name. Mr. Wenderoth, the inventor, communicated the following instructions for its production:—

Select a vigorous, clearly-defined impression, with margin enough to allow for mounting upon the painter's stretcher or painting board. Damp the print with a sponge dipped in clear water; then paste its edges upon the stretcher, and with clean paper over its face rub the print down smoothly. When dry, it will be tight and firm for the artist to operate upon. Or mount it upon a sheet of glass with its edges ground to hold the paste. The photograph is now coloured upon the face as a miniature, with permanent colours; but colours much stronger than those commonly employed on surface-painting, as in the manner of mounting the completed pictures upon plate-glass, has the effect of lowering the tone of the colours used. As transparent colours are reduced, or lose considerably in tone by this mode of mounting, they should be painted in much more strongly than for surface-painting; while the body colours should be kept down or reduced in tone, since they are heightened or made more brilliant and vigorous by the manner of mounting.

The coloured print is now mounted on a perfectly clean sheet of plate-glass, face downwards, as follows:—Melt bleached pure white wax, and, while hot, pour it upon the glass plate, which is also made and kept hot on a steel or iron plate, or a soapstone slab, under which one or two spirit lamps are continuously burning. While the wax is quite liquid take the print by the ends, spring it in the middle, and lower it gently into the heated wax, carefully pressing from the middle outwards both parts of it down into the wax, and then with a straight-edged paper-folder, of ivory or bone, or some similar article suited to the purpose, press and work out all the air-bubbles and superfluous wax. This operation must, of course, be executed while the plate is quite warm. The paper-folder should be carefully rubbed from one extremity of the print to the other without lifting it therefrom or suspending the process, as a mark would thus be left on the picture, which will be thoroughly saturated with wax, and which, if properly handled, will be transparent, smooth, and beautiful. Some artists use a compound of one part gum dammar to eight parts wax; or Canada balsam and wax; or gum elemi and wax; in the proportion of one to eight parts of wax. Others use a larger proportion of the gum varnishes.

Finally, the picture is finished by placing upon its back and firmly sealing to the glass a clean sheet of white paper or cardboard, with a cardboard border, or mat between the picture and the paper, and with small lumps of hard wax stuck upon the dark or opaque parts of the picture, so arranged as to keep them about one-sixteenth or one-twentieth of an inch asunder. This distance must be determined by effect or appearance produced, and regulated by the judgment of the artist, when the picture is ready for the frame. Sometimes a duplicate *tinted* print of the face is placed behind to give more colour vigour.

CHAPTER III.

THE EBURNEUM PROCESS.

The appearance of prints produced by this method of printing is strongly suggestive of pictures on ivory; hence the name (*Gr. Ebur—ivory*). The prints were exceedingly soft and delicate, and wherever exhibited elicited universal admiration. The process originated with Mr. Burgess, of Norwich.

The first part of the process consists in producing a transparency on glass.

The glass plate should, before being coated with collodion, receive a slight coating of an ethereal solution of wax according to the method first described in THE BRITISH JOURNAL OF PHOTOGRAPHY, by Mr. Wenderoth, of Philadelphia. (See Chapter II.) This is then rubbed off, but sufficient will still remain to effect all that is required by this treatment.

The plate is now coated with a tough collodion, and exposed either in a copying camera or under a negative.

The development should be conducted in a precisely similar manner to that on opal glass. Care must be taken that it is not developed so far as would be required for a good transparency, as in that case it will prove to be much overdone for this purpose, and the finished picture will be dark and heavy.

After fixing, tone the picture either by means of chloride of gold solution or bichloride of mercury, with the subsequent application of a very weak solution of sulphide of ammonium. The picture should now be washed, and allowed to dry spontaneously.

Having been placed on a levelling stand, there is now poured over the face of the picture a solution prepared thus:—Put five ounces of gelatine to soak in twenty ounces of water. When it has swelled up, which it will do in a few hours, place the vessel containing it in another vessel of hot or boiling water; by this means the whole will be liquefied. Now place in a mortar one ounce of oxide of zinc, half an ounce of glycerine, and about an ounce of water. Mix thoroughly together, and then add it to a warm gelatine solution, which should be previously filtered through flannel. After stirring well together allow it to repose for one or two hours, and decant from any sediment which may have fallen.

This is the solution which is poured over the picture. When used it should be warmed to about 100° Fahr. The plate thus coated with gelatine should be retained in its level position until the film is quite set, after which it may be put aside in a warm place until quite dry, which will occupy about thirty-six hours. At the end of this time it may receive a coating of ether, plain collodion, or of spirit varnish, and when this has become dry a penknife is run round the margin of the film, which will at once leave the glass plate. The edges of the picture must now be trimmed, and the picture finished.

The object of applying the wax to the glass plate before coating with collodion is to cause the film to leave the plate with greater certainty when the gelatine has set than it might otherwise do.

Should the film show a liability to become detached during the operations of developing, washing, etc., this may be obviated by charging a camel's-hair brush with a solution of india-rubber in benzole (six grains to the ounce), and passing it round the edge of the glass to the width of about an eighth part of an inch.

It is important that the gelatine be thoroughly dry before removing it from the glass. The inventor found that about thirty-six hours in a temperature of between 60° and 70° will effectually do this. If tco short a time has been allowed for drying, the surface of the picture is apt to become dull.

By these instructions any careful operator will be enabled to practise the "eburneum process" without much risk of failure. Hurried or imperfect drying of the gelatine will prove the most common source of failure; but bearing in mind the time specified—thirty-six hours in a warm room—this may be effectually guarded against. There is a delicacy, a transparency, and general beauty about these pictures which should commend the process to those who can appreciate such desirable qualities in this class of photographic pictures.

CHAPTER IV.

Cooper's Modification of the Eburneum Process.

[The folowing Modification of the Eburneum Process, was due to Mr. H. Cooper, jun., of Northampton.]

To prepare the so-called "eburneum," soak an ounce of good and rather *white* gelatine in four ounces of water. When quite soft, dissolve by the application of gentle heat, and add sufficient oxide of zinc, barytes, or other insoluble white pigment in an almost impalpable powder. Moist Chinese white answers admirably. A small portion of any other pigment may be added if it be desired to tint the eburneum. The introduction of a little pink is sometimes very suitable, as it gives a slightly roseate tint to the finished picture. Sufficient of the pigment must be *well mixed* with the gelatine solution to render a rather thin layer of it opalescent. After the pigment add forty drops of glycerine, to give pliability to the gelatine. A small quantity of an essential oil, such as lavender or otto of roses, may also be added, which will delicately perfume the eburneum.

To prepare the sheets of imitation ivory on which the picture is to be transferred, we must coat a clean plate of glass with a strong-bodied plain collodion, and when that is quite dry, coat with a sufficient quantity of gelatine solution, which must be strained free from bubbles, etc. After this tissue, as we may call it, is perfectly dry, it is to be removed from the glass, and placed in a portfolio till required for use. The operation of performing this tissue is precisely similar to that adopted for Mr. Swan's carbon process, with the exception that a white pigment is used instead of a black one. Now to print our picture. I would advise that the collodio-chloride be purchased ready prepared, as by doing so some trouble is avoided. If, however, any should wish to prepare it for themselves, they can do so, using the formula given by Mr. Simpson for printing on opal glass. It will stand about thus:—

Plain collodion	1 ounce.
Nitrate of silver	9 grains.
Chloride of strontium	2 grains.
Citric acid	1 grain.

Now take a piece of mica, and, by moistening one side of it, affix it to a plate of glass larger than itself. After removing dust, coat with *plain* collodion. The collodion for this purpose should give a textureless and perfectly transparent film. When dry, coat with the collodio-chloride, and place the plate, just as it is, in such a way that no draught can touch it. If it be disturbed before it is dry, or if the temperature be altered during the process, stains and markings will result. When dry, the talc may be removed from the glass by first raising one corner with a penknife. It is then to be slightly warmed and allowed to become cold again. It is now ready for printing. But before proceeding to that part of the process, a word may be said on the reason for coating the talc with *plain* collodion before the collodio-chloride. I have found that I have obtained a better print in every respect when using it. This, of course, is a great recommendation, but there are others that will be discovered when working the process. Two advantages that have been derived from its use are, that no care need be taken to clean the mica, and that the operation of transferring is rendered more entirely certain. One effect of it is very curious. With the samples of collodio-chloride that I have tried, the pictures that have had the plain collodion have been more brilliant than those that had it not. Therefore, as very little extra trouble is caused by it, and as the advantages are very manifest, I say, adopt its use by all means.

Now lay the coated mica carefully upon the negative, covered with a piece of white paper, then something soft; and, after replacing the back of the pressure frame, expose to light until the print is very slightly over-printed. During printing it can easily be examined by lifting the mica from the negative, as we should do a piece of paper, taking care not to bend it back too far, for fear of cracking it. The use of the white paper over the back of the mica is to enable the printer to see what progress is being made in the printing. Be careful only to examine the print in very dull or yellow light, as the least sullying of the delicate half-tones and high lights will detract greatly from the beauty of the finished picture. If a frame such as is used for printing on opal glass be employed, glass may be used instead of mica to obtain the print. But for several reasons, which I need not here enumerate, I prefer and recommend the mica.

When sufficiently printed, remove the mica from the pressure-frame, and run a brush charged with varnish round the edges to prevent the film slipping in toning and fixing. A good varnish for the purpose is the following:—Methylated alcohol one ounce, common shellac half-drachm, gum benzoin half-drachm. Now slightly wash the print, and tone in a very weak and old acetate toning bath. The toning proceeds so rapidly that if a bath of the ordinary strength be used, the picture will be quite spoiled in a very few seconds. Should you not have any old toning solution by you, the best plan is to first tone all your paper prints, and, after diluting the nearly exhausted bath, use it to tone the collodio-chloride prints. If this is not practical, take an ounce of your ordinary acetate toning solution and largely dilute it with water.

When your print has reached the proper colour, rinse with a little water, and fix in a solution of hyposulphite of soda—strength, one ounce of the salt in eight ounces of water. After gently washing the print, to free it from the hypo, it may be placed aside to dry. The plate of mica should not be laid in a horizontal position to dry, but allowed to lean against a box, or something else, with the lower edge resting on blotting paper.

It may sometimes happen that during some of the operations of washing, toning, or fixing, the film may become partially detached from the mica. Do not despair, for with care you can yet save your picture. Remove the print carefully from the liquid in which it may be immersed, by first withdrawing the edge where the film is still attached; this will prevent the liquid from running between the film and mica when it is taken out of the solution. Now gently pour some water upon the centre of the film, letting it run off at each corner alternately until the film lies flat upon the mica. Now stand it up to dry, taking care that the edge where the film is loosened be lowest.

When dry, slightly warm, and run a brushful of varnish round the edges. Let it remain a little while for the varnish to dry, then moisten the surface with water, and proceed with the operation of toning, etc. When the picture is successfully toned, fixed, washed, and dried, it is ready for transferring to the imitation ivory "eburneum." To accomplish this, we cut a portion of the required size from the sheet that we placed in the portfolio, and soak it for a few minutes in a bath composed of water one ounce, alcohol two drachms. We now take our sheet of mica, with the picture upon it, and by moistening the reverse side, attach it to a plate of glass, and well wet the surface with the mixture of alcohol and water, same as used for the eburneum sheet. We now take the moistened sheet of gelatine (the eburneum) and place it upon the surface of the print, beginning at one corner, and gradually letting it fall upon the print much in the same way as a sheet of albumenised paper is laid upon the sensitising bath. By this means the water and alcohol remaining between the surfaces of the print and eburneum are expelled as they come together, thus enabling us to be free from air bubbles. A piece of bone with a perfectly straight and bevelled edge is very useful for carefully rubbing over the back of the eburneum in order to get it in actual contact with the film carrying the picture. I scarcely need say that the side of the eburneum that is coated with collodion must be uppermost. When the whole is perfectly dry, the eburneum may be removed from the mica, bringing with it the picture, which will be found firmly attached to the surface of the pigmented gelatine. After trimming the edges, our picture is finished; and although some little extra care and trouble have been used in its production, I think its beauty will amply repay all the care that has been expended upon it. If thought preferable, a piece of paper may be coated with the pigmented gelatine, and used in the same way, and instead of the sheet of eburneum; but though the effect is very fine, it is not quite equal to the eburneum picture.

CHAPTER V.

CRYSTOLEUM PICTURES.

Carefully executed crystoleum pictures have a most attractive appearance. Here are brief working details of two processes:—To remove the mounted photograph from the cardboard, immerse in clear cold water, and when the paste is sufficiently softened, separate them carefully to prevent injury to the print. Remove all paste from the print, and cut it a trifle smaller than the glass on which it has to be mounted. Lay it between the folds of blotting paper until nearly dry. Having prepared some Tragacanth paste, coat the face of the print and concave surface of the glass with it, using a fairly large brush. Make a compound of white wax and camphor, which place in a small tin tray; place this tray in a dish of hot water sufficient to melt the compound; when melted, immerse the glass-mounted print in it, and leave it there till you see it become transparent. Remove from the tray then, and when cold scale off the compound with the fingers, brushing all remaining particles carefully away with a small bristle brush. The compound can be remelted and used again and again. The colour may now be applied to the eyes, lips, jewellery, lace work, or parts that require no blending. Paste narrow strips of cardboard to the concave edge on top, bottom, and sides; then lay another glass the same size, with the convex surface towards the concave side of the first; on the clear glass paint hair, complexion, drapery, and background. You can remove the colour wholly or in part by applying a little megilp with a soft cloth.

The colours used are in oil, and to the following directions:—

EYES, *blue*—ultramarine blue with a little ivory black; *brown*—Vandyke brown; *grey*—ultramarine blue, Vandyke brown, and flake white.

FLESH.—Vermilion, flake white, and Naples yellow; for children use carmine in place of vermilion; for dark complexions deepen with Vandyke brown.

HAIR, *blondes*—chrome yellow, burnt Sienna; *brown*—Vandyke brown; *black*—ivory black, flake white, adding ultramarine blue; *grey*—flake white, Naples yellow, ivory black, ultramarine blue.

Another method is to take one of the bevelled glasses to be used and warm it gently, then coat the surface to which the picture is to be transferred with Venetian turpentine; use a hard brush so that the coating may be as thin as possible; wet the print, then dry it between blotting paper and apply it to the glass; see that it is well rubbed down all over to prevent air-bells, which leave little glistening marks on the finished picture if the adhesion all over is not strictly attended to. The glass may continue to be warmed, which facilitates the drying. When dry, wet the paper again, and reduce it by scraping with the finger; then smooth it down with pumice-stone; now apply spirits of turpentine to give the necessary transparency. This picture is then ready to be painted on (for colouring, etc., see previous method). When finished, it is backed up with transfer paper, which does away with the second glass used in the old style of chromo picture.

CHAPTER VI.

ENLARGEMENTS BY SUN PRINTING.

At one time the following method, which was introduced by the Dr. Monckhoven was very popular. It is described in his own words :—

Nitrated sugar (nitro-glucose) decomposes rapidly in the presence of alcohol, and gives under the simple action of light, in presence of an excess of nitrate of silver, a brown solution exactly similar to that yielded by albumen; and, what is still more remarkable, instead of becoming yellow under the influence of gallic acid, like albuminate of silver, this body remains white. Paper immersed in an alcoholic solution of nitro-glucose, decomposed, dried, sensitised, exposed for a very short time to the light behind a negative, and then immersed in gallic acid, allows the image to appear very shortly of a most beautiful colour; analagous to those on albumen, and capable, like these latter, of being fixed and toned, without losing the beautiful tone they had in the developing bath.

I now come to the practical description of my process :—I begin by preparing the *nitrated sugar*, by placing one part of powdered white sugar in a mixture of one part of sulphuric acid and one part of monohydrated nitric acid. In five minutes I remove the mass, and wash freely in a stream of water. It is then dissolved in alcohol, and precipitated by water. I thus obtain a white glutinous substance, which is nitrated sugar. I would add that this is a very delicate preparation, and without the discovery which I have made of a very simple mode of preparation my process for the preparation of paper would have proved impracticable. I dissolve 176 grains of this nitrated sugar (or nitro-glucose, as it is called in strict chemical *parlance*) in one pint of alcohol, and the solution being made in a stoppered bottle, I place it in a sugar-refiner's stove at a temperature of 43° C. for eight or ten days. At the end of this time all the nitro-glucose is decomposed, and the liquid, which at the commencement of its preparation did not produce a precipitate with nitrate of silver, now produces a white precipitate, which blackens with extreme rapidity on exposure to light. The alcoholic solution is poured into a porcelain pan, and sheets of paper are passed through it and hung up to dry. I use papier Rive, and proofs of large-sized drawing paper, which I buy by the yard. The paper is dry in a few minutes. I then immerse it for two hours in an ordinary solution of salt (one part of salt to ten parts water), and then hang it up to dry. I can thus preserve my paper, but I prefer generally to sensitise it at once, and preserve it in that condition. For this purpose, I pass it simply through a solution of forty-four grains of nitrate of silver dissolved in two ounces of water. I dry it by suspension, and preserve it thus for several months ready to be used.

What is very remarkable is the extreme sensibility of this paper, and the colour which it assumes under the influence of light. With reference to its rapidity all that I can say is, that yesterday I made twenty-four enlargements from the same negative in *one hour*. Each enlargement, being 24 × 20 inches, was made by means of my apparatus by one minute's exposure to the sun, and the rest of the time was occupied in changing the sensitised papers. Under an ordinary negative a marked image is obtained in less than ten seconds. The colour assumed by the paper under the influence of light is a clear violet, redder than ordinary chloride of silver. When a number of proofs have to be prepared they are immersed altogether in a bath composed of eight grains of gallic acid to a pint of water, to which is added one and a half drachms of crystallisable acetic acid. They here assume a magnificent colour, and, I repeat it, comparable in every respect to the most beautiful albumen prints. After development the proofs are toned and fixed, as is done in the ordinary process. When dried the proofs are coated with gum encaustic paste, or varnished. My opinion is that this process will make the question of enlargements a practicable one. In fact, I have enlarged on this paper from negatives taken some years since very dense and varnished, and that in less than five minutes' exposure to the sun. With a transparent negative taken expressly for enlargement, and my large apparatus, a double sheet is printed in two minutes—a single sheet in one. The silver baths being weak, there is great economy. Finally, as in winter photographers can only obtain one or two proofs a day from their negatives, they can now obtain more than three hundred.

CHAPTER VII.

PRINTING ON CANVAS.

The following method of printing on canvas was due to Mr. Peter Lothian, of Edinburgh. The process is applicable to printing on all impervious or semi-impervious substances, as well as canvas:—

The oily surface which painters' canvas presents is the first difficulty which must be got rid of, and it is done in this way:—Get your canvas ready, lay it flat on a board, sponge it over with spirits of wine (or you may use carbonate of soda or any other alkali) till the surface is free from all greasiness. Be careful not to rub the surface overmuch. Then make the canvas into a sort of dish by bending up the edges, and pour over the surface a solution of citric acid dissolved in spirits of wine. Drip it well, and, when nearly dry, pour a solution of spirits of wine and chloride of calcium over the canvas for about five minutes; pour off, and allow the canvas to dry. When dry, float on it a solution of nitrate of silver of the ordinary printing strength for four or five minutes.

"I have printed canvas prints when the silver was only forty grains and found very little difference in the prints. Print in the usual way; do not print very deep; then fix with hyposulphite of soda. I have found that old or weak soda answers best. Toning with gold is quite unnecessary.

FORMULÆ.

1. For washing the canvas:—Equal parts of methylated spirits of wine and water, or a solution of carbonate of soda in water, after which wash freely.

2. After washing, coat with—

Spirits of wine	1 ounce.
Citric acid	from 15 to 20 grains.

3. Salting solution :—

Spirits of wine	1 ounce.
Chloride of calcium	10 grains.

4. Sensitising solution :—

Nitrate of silver	50 grains.
Distilled water	1 ounce.

Considerable latitude is allowable with these quantities.

Another way by which many modifications of colour can be got is to prepare the canvas surface as above. When washed and dried the surface is to be chlorided by the application of a solution of the salt chosen, keeping the equivalent of chloride equal to about five grains of chloride of sodium to one ounce of water, and spirits of wine in equal quantities; add to this from one to two grains of either gelatine, starch, albumen, or similar organic substance, and add about ten grains of citric acid. Float this on the surface as directed; then, when dry, apply the nitrate of silver, and print.

The printing is much more rapid than in the case of ordinary paper printing, only about one-third of the time being needed for the canvas that is required for an ordinary quick-printing paper.

I prefer, where possible, to use a large printing-frame to ensure perfect contact with the negative and canvas surfaces, otherwise the usual want of sharpness and decision will be visible.

This method of printing is applicable to direct as well as to enlarged negatives; and the prints now submitted include several of both kinds.

Much washing is not required, as the hyposulphite does not penetrate into the impervious surface of the paint; indeed, in this respect, it is much like printing a transparent positive on glass.

CHAPTER VIII.

THE DIAZOTYPE OR PRIMULINE PROCESS.

This process consists in making postitive coloured prints upon paper, silk, or other fabrics. It is founded on the property of primuline—a golden coloured amorphous powder, discovered by Mr. Green, of the firm of Green, Cross & Bevan, manufacturing chemists—of becoming nitrated by nitrous acid. It is thus converted into a compound affected by light. Primuline is very readily dissolved in water. Any vegetable fibre, paper, silk, etc., placed in even a weak solution of it for a few moments will be dyed a primrose colour. For photographic purposes the following process is carried out. The material is dyed in a weak solution of primuline to the desired shade. After dyeing the material is placed in a solution of nitrous acid, which converts the primuline into diazo-primuline. This compound has a deep orange colour, and is very sensitive to sunlight, which bleaches the colour to a pale primrose. After washing in water the print retains this colour. As this is a positive process, a positive must be used in printing. Print under a positive, or an oak leaf, for instance; the portions of the surface protected from the action of the light will not be bleached, but will retain the deep orange colour produced by the nitrous acid bath. If a leaf had been used, for instance, and printed upon silk, we would have a deep orange coloured leaf printed upon a pale primrose coloured background. After washing in water the colours are permanent. This pale primrose colour can be modified by treatment with various aniline and other dyes. If the finished print is treated with an alkaline solution of beta-naphthol—¼ per cent. solution is strong enough—the primrose background will be converted into a deep red colour. Phenol in solution turns it yellow. Resorcin solution turns it orange, etc. Ornamental effects can be obtained with this process upon all kinds of fabrics with very slight trouble.

Exact working formula is as follows:—In 10 ounces of water dissolve 150 grains primuline by heating in a glass vessel to boiling. If a Bunsen burner, tripod, wire gauze and glass heater are at hand, the process is simple. If these cannot be had, then proceed as follows: Measure 10 ounces of water (or proportionate part if desired) into a white glass medicine bottle, selecting one with a uniformly thick bottom, and add the primuline. Then into any suitable tin or iron dish put a layer of sand an inch or two deep. Place the bottle in the sand, and put sand about the bottle until it reaches the height of the water in the bottle. Then place upon a stove and heat. In this way the water can be heated to the boiling point with comparative safety. If calico is to be treated, the sizing must be removed first. For this purpose it must be boiled in water to which a few drops of sulphuric acid have been added, and then well washed in clean water. The sizing consists of starch. By boiling the calico with the acidulated water the starch is converted into sugar. This in turn is easily removed from the fabric. Pour the hot primuline solution into a porcelain dish, and then place the fibre to be dyed into it. Move the piece or pieces about, in order to ensure even dyeing. After ten minutes or so take the fabric out of the bath, and give two or three washings in cold, clean water. Twist up and remove as much water as possible, and then flatten out between sheets of paper to see if the dye is uniform.

The next process is sensitising. Make a solution of —

Nitrate of sodium	50 grains.
Water	18 ounces.

And to this add hydrochloric acid ¼ ounce.

Immense the dyed fabric in this solution, and we get the light sensitive diazo-primuline. In this bath, as in the dye bath, the fabric must be moved about in order to insure uniform reaction. As soon as it takes on a uniform brownish red colour it is removed from the sensitising bath, run through three or four changes of fresh water to remove all free acid, and is then spread out on blotting-paper or hung up by clips to dry. The drying must be spontaneous. Application of heat destroys the printing qualities.

Print until a decided colour change is observed. The next step is to develop. In order to insure uniform action of the developer the print is first soaked in water until uniformly wet. It is then pressed between paper (or wrung out by the hand) to remove as much water as possible, and is put into the desired developer. Various developers can be used.

DEVELOPER FOR RED.

Beta naphthol	40 grains.
Caustic soda or potash	60 ,,
Water	10 ounces.

Dissolve the soda or potash in half of the water. Pour into a mortar. Add the naphthol, and rub in the rest of the water. Add in small portions under trituration.

DEVELOPER FOR ORANGE.

Resorcin	30 grains.
Dissolved in water	10 ounces.

After solution add caustic soda or potash 50 grains.

DEVELOPER FOR PURPLE.

Naphthylamine	60 grains.
Hydrochloric acid	1 fluid dram.

Rub up in a mortar and add water 10 ounces.

Especial developers recommended are:—

FOR BLACK TONES.

Eikonogen	60 grains.
Water	10 ounces.

After developing wash with soap and water, and finally with clean water, press or iron between clean sheess of paper, and the prints are finished and permanent as the material on which they are made.

[The foregoing details are taken from Dr. Stiefel's excellent book on "Plates and Papers," but substantially they differ very little from the particulars given in the "British Journal of Photography," when Mr. Green intraduced the process.]

CHAPTER IX.

THE ARTIGUE PROCESS.

Artigue printing is not much practised nowadays. Mr. Alfred Maskell who was *facile princeps* at the process is responsible for the following details which the devotee of the personal equation element in printing may safely follow. Mr. Maskell was very successful in his results.

The Artigue paper, when of good quality, and properly used, may be said, for delicacy of delineation and other characteristics, to be equal to any other paper now in the market, both for pictorial and for scientific work. For what we call artistic work in photography, I still think that it is better to coat the paper oneself; but this is undoubtedly a matter of difficulty, requiring a considerable amount of practice, and very few will have the patience and other necessary qualities to succeed in so doing.

To take, however, each case separately, and first the Artigue Papier Velours. This is, at present, coated upon a paper of medium roughness, slightly rougher perhaps than the AA. of the Platinotype Company, and with an excellent and even grain. How far it may be possible to proceed in the direction of rougher papers, one cannot at present say, but there is little reason to be dissatisfied with the paper at present in use. The coating is of extraordinary fineness and homogeneity, a pigment of some peculiar black, mixed with a little gum, and possibly some gelatine or glue also. Viewed by reflected light, it is a dead, velvety black, and so soft that a moist finger easily removes it. By transmitted light the paper is transparent, with a quite light grey appearance, very regular indeed, with no apparent surface faults. The secret of its quality, in fact the whole secret of preparing paper for development from the front, is the extreme tenuity of coating, and the perfection of evenness in which the pigment is held in suspension, allowing of its absolute regularity in distribution. What the pigment is, what the colloids, and how the coating is affected are still the secrets of the maker.

The paper is supplied unsensitised, and in that state will, of course, keep indefinitely. The earlier method of sensitising was by a tedious and somewhat difficult process of brushing on the back. In my paper on the subject last year I showed that a simpler way, that by immersion, was quite as efficacious, and seemed to present no differences in result, except perhaps an increase of sensitiveness. At first, also, development was effected with baths of comparatively high temperature. Now, development is practically cold throughout, at least at a temperature no higher than that of water in summer. A brief statement of the manipulation will be useful.

To sensitise, prepare a two per cent. solution of bichromate of potash in a flat dish. Immerse the paper in this gently to avoid air bubbles for two minutes, and hang up by one corner to dry in the dark. As the pigmented surface is so very tender and easily rubbed off if touched when wet, I find it convenient to put a little metal clip at each corner of the paper, to lay it on the bed of the dish, flow the solution over, and handle by the clips only.

Exposure is made with an actinometer in the usual way, and the paper, when fresh, has quite three times the sensitiveness of silver paper, say about the same as platinotype.

For development, sawdust in the state of a pretty thick soup is used. Of course, this is of no necessity; a brush, rocking, laving, flowing from a sponge, plain water, and other ways would develop in time, but the sawdust, which is in extremely fine powder, is, by its soft, rubbing action, very useful. Make, then, in a large, very deep, earthenware pan, a thick soup of this sawdust and cold water, and have ready a coffee-pot or similar utensil, with a very wide (about an inch wide) spout. After exposure, take the paper, and place it in water at as near as possible seventy degrees (not more). In two or three minutes a faint image will be seen. Lay the paper on a sheet of glass, and, placing this on an easel over the pan, or holding it in the hand, pour the sawdust mixture along the top of the print, letting it run down back into the earthenware pan. At first the sawdust mixture should be taken from the top; afterwards, by dipping down and stirring up, it may be taken thicker. The character of the negative and the degree of exposure will determine the thickness of the developing mixture and the manner of applying it. Evidently also local development is extremely practicable, and the touch of light brushes, or other means, will come into play, for, even where affected by light, except where it is very deeply printed, the pigment is still soft and soluble, and amenable to treatment. Every now and again a dash of cold water will reveal the picture and satisfy us as to the progress of the development, and, finally, the usual alum bath, to discharge the bichromate and harden the pigment, will complete the print. Throughout, the operations have been with cold water only. There has been no anxious inspection of thermometers, no squeegeeing, no transfer from one support to another, no pressure between blotting boards; we can suspend and take up again development when we will; there is no film to blister and leave the paper, no safe edge to make to the negative, and, finally, there is no reversal, end for end, of the picture, but we have a true positive from a negative, even as in silver printing. We have left also little else but pure colour on the surface of the paper, without the disagreeable soapy gloss of a thick gelatine film holding it there in suspension.

CHAPTER X.

OZOTYPE.

I condense the following from a small handbook published by Mr. Manley the patentee of the process :—

Ozotype is a modification of the carbon printing process, and produces permanent photographic pictures in various monotints. Paper is rendered sensitive to light by the operator coating the paper, by means of a brush, with a sensitising solution sold by the Ozotype Company. The dried sensitive paper is exposed under a negative to daylight in the usual way. A plainly visible image is the result. This initial print is washed in water and dried, when it will keep for years in a dry place. A piece of pigment plaster (which is paper coated with pigmented gelatine) is applied to the initial print under the surface of a bath comtaining acetic acid and hydroquinone. The print and pigment plaster, clinging together, are removed from the bath and squeegeed together. After the expiration of a few hours, or any time afterwards, the picture is developed in hot water.

The advantages claimed for Ozotype are: A distinctly visible image instead of having to use an actinometer. There is no reversal of the picture with regard to right and left, therefore no transfer is necessary. No safe edge is required in this process. The fingers do not come in contact with a bichromate salt in any of the operations. The sensitising solution will keep indefinitely, and is not sensitive to light until it is spread on the paper and dried.

The pigment plaster is not rendered sensitive to light, and will therefore keep indefinitely. The operations can be carried out in convenient stages; the initial print may be made and washed, and the pigmenting can be done at any convenient time afterwards. The materials are not affected by extremes of temperature, and the operations can be carried out easily in either hot or cold climates. In Ozotype any error in exposure can be detected before the plaster is used, and the spoiled print, which costs next to nothing, can be thrown away.

The worker may select any good drawing paper, such as Cartridge, Whatman, Arnold, O.W., Michallet, Turkey Mill, etc., upon which charming pictures may be easily produced, with this advantage—that the characteristic quality of the paper may be used to enhance the pictorial effect.

A preliminary sizing of a 3 per cent. solution of gelatine or a 10 per cent. solution of fish glue may be given, but it is not necessary to make the sizing of the paper a separate operation. If a suitable colloid or mucilaginous substance be added to the sensitising solution, the coating is more easily performed, and is quite as effectual as when an already sized surface is dried, and the sensitising solution applied afterwards. The tools required are a good brush, a few drawing or photographic dark-room pins, and a few yards of soft butter muslin or an old silk handkerchief. A suitable brush is essential; it should be a flat, soft, hog hair brush, three to four inches wide.

The practical method of sensitising is described below:—

Make up a sizing solution:—

Lepage's clarified fish glue	1 dram.
Warm water	5 drams.

Lay the paper to be sensitised on a large sheet of any clean paper, and pin the four corners down with drawing pins. Let us suppose that a half-sheet of royal size paper is going to be sensitised. Pour into a two-dram graduated measure 1 dram of the sensitising solution. Add to this quantity 10 to 20 minims of the sizing solution. The fish glue will coagulate; but do not stir the solution, as the friction of the brush on the paper will churn, and mix it up thoroughly. Throw the contents of the measure on to the middle of the paper with your left hand, and, without losing any time, take the brush in your right hand and drive the puddle all over the paper with a vigorous zigzag or rubbing motion until the whole surface is covered with a mass of lather. Then by horizontal and vertical strokes of the brush, increasing in lightness, the paper will be smoothly and evenly coated.

The best negative for printing is one that will give good prints in platinotype, but excellent pictures can be produced from negatives of different qualities by varying the ingredients of the acetic solution. Expose to daylight, and continue the printing until the details in the high lights are visible, when it will be time to withdraw the print from the frame. The finished prints should next be washed. This is done by placing them in a dish of cold water, and allowing running water from a tap to play on a corner of the dish for ten minutes, occasionally turning the prints over and separating those that cling together. If kept too long in water the image is weakened. If the prints are to be pigmented at once, surface-dry them between blotting paper, otherwise they may be hung up or placed upon blotting paper to dry. Prints on paper which has become stale through keeping will require longer washing.

Pigmenting the Initial Image.

Make up one of the undermentioned acetic solutions, and pour it into a porcelain dish of the required size. The dish should be larger than the print to be pigmented—say a whole plate dish for a half-plate print, or a 12 by 10 size for a 10 by 8 print. An acetic bath suitable for prints from brilliant negatives, giving good results in carbon :

A.	Water	40 ounces.
	Glacial acetic acid	50 minims.
	Hydroquinone	20 grains.
	Sulphate of copper	20 grains.

An acetic bath suitable for prints from negatives, giving good results in platinotype :

B.	Water	40 ounces.
	Glacial acetic acid	60 minims.
	Hydroquinone	20 grains.
	Sulphate of copper	20 grains.

An acetic bath suitable for prints from rather thin negatives, giving good results in P.O.P. :

C.	Water	40 ounces.
	Glacial acetic acid	70 minims.
	Hydroquinone	20 grains.
	Sulphate of copper	20 grains.

As the crystals of sulphate of copper will take some time to dissolve, it is very convenient to make up a 10 per cent. stock solution, and add 200 minims of this in place of 20 grains of the crystals.

A 10 per cent. solution of sulphate of copper is made up as follows, and will keep indefinitely :

D.	Distilled water	10 ounces.
	Pure sulphate of copper	1 ounce.

If tap water is used the solution should be filtered.

The acetic solution will keep good for about two weeks, but, of course, it becomes weakened, and charged with gelatine and pigment. after constant use. It is advisable to filter it after it has been used a few times. The working temperature of the acetic bath should be 70° to 75° Fahr. for smooth paper, and 80° Fahr. for rough paper. The latter temperature is just below the melting point of the gelatine, so do not let the thermometer go up any higher. To heat the acetic solution an ordinary cheap atmospheric gas stove may be used.

Place a piece of asbestos cardboard or safe boiling stove mat on the stove to prevent the porcelain from cracking, and put the dish on the top of this. Immerse the bulb of a thermometer and light the stove. Watch until the thermometer indicates 70 degrees. When the mercury reaches this figure put out the fire, and you will find it go up about 6 or 7 degrees, owing to the residual heat of the asbestos. Now take a piece of pigment plaster (the size and colour required), and plunge it, pigment side downwards, under the surface of the solution, and leave it there for half a minute, then turn it over and brush away any air bells that may have accumulated. At the expiration of another half minute (making together one minute's immersion) take the print and insert it under the surface of the solution (which should take no more time than is necessary to remove air bells), and bring it in contact with the gelatine surface of the pigment plaster, and draw the two pieces clinging together out of the solution, and squeegee them together on any flat, non-absorbent surface, such as papier mâché board, glass, or zinc. It is most important that the application of the print to the pigment plaster should be done under the surface of the solution. In this operation the power of controlling results with regard to under or over-exposed prints may be exercised. If the print is under-exposed keep the plaster (not the print) in the solution for a longer time—say one and a half to two minutes. If over-exposed immerse the plaster for a shorter time—say thirty or forty-five seconds.

After squeegeeing place the plastered prints between blotting paper, and put a heavy book on the top. The second print when squeegeed should be placed on the top of the first, and so on, the weight being removed and replaced as each print is added. Some prints, especially those which have been deeply printed, may be developed at the expiration of about three hours. In this case they should be placed at once in the warm developing bath, no preliminary immersion in cold water being necessary; but where development is deferred the plastered prints should, after being left under the weight for a few hours, be laid upon blotting paper or hung up in a cool room. The object is not to specifically dry the print, but to allow time for the acetic solution to act. If the prints were to remain for twelve or more hours under pressure, the paper might become tender.

DEVELOPMENT OF THE PICTURE.

Apparatus required:—

Gas Stove.—The same as used for the acetic bath. *Developing Tank.*—Any iron, tin, or copper vessel of suitable size will do. *Tin Mug.*—Enamelled iron cup can be purchased for a few pence at any hardware stores. *Sheets of zinc* (size of print to be developed) to form a rigid support to the picture during development.

If the plastered prints are dry they require soaking in cold or luke-warm water for about half an hour in winter, or fifteen to twenty minutes in summer, previous to development.

If wet (which will be the case if left under pressure for three hours or more) they may be plunged at once in the warm developing water.

Place the developing tank over the stove, and pour a sufficient quantity of water into the vessel to occupy a depth of about four or five inches. Ignite the stove and immerse the bulb of your thermometer. Raise the temperature of the water to about 110 degrees Fahr. Take a plastered print that has been immersed in cold water for the requisite time, and plunge it beneath the surface of the warm water. In about one minute after immersion, try if the backing will come off by a slight forward pressure between the finger and thumb at each corner of the print. If the plaster backing separates from the print at each corner, strip the backing of the plaster from the print by taking hold of one corner and peeling it off under water. This operation requires slightly more force than in ordinary carbon printing, and should be done straight off without stopping and under the surface of the water. If the four corners of the plastered print do not yield to the pressure of the thumb and finger, keep it in the hot water for a longer time. It will now be seen that the greater part of the pigmented gelatine has attached itself to the print, and that the plaster backing (which should be thrown away) shows an impression of the image. The print is now ready for development, and may be placed upon blotting paper until the plaster backing has been removed in the same way from the remainder of the prints.

The development of the picture is a fascinating and agreeable occupation, and is carried out in the same water in which the plaster backing was separated from the prints. The temperature of the developing water should be 105 to 110 degrees Fahr. Plunge one of the prints, from which you have removed the plaster backing, into the hot water, face downwards, and leave it there until the gelatine has become loosened, then turn it over and take one of the zinc plates (the size of the print), and place it underneath the print so as to form a rigid backing, and by holding the print on to the zinc plate by two opposite corners with the thumbs, move it upwards and downwards in the water until the high lights of the picture appear. Now take your little mug and wash away all soluble gelatine by pouring mugfuls of warm water gently over the picture until it is fully developed.

Should the picture not develop easily, leave it in the warm water a longer time, and it will develop much more quickly with the mug afterwards.

If the development is judged to be completed, the picture may be at once immersed in a solution of—

Alum	1½ ounces.
Water	40 ounces.

for five minutes, and rinsed in clean water.

But it is often more convenient to allow the picture to dry without the alum bath, so as to admit of subsequent local development, as the appearance of the dried print is different from that where the gelatine is in a swollen condition. But it is essential that the alum bath should be used before mounting the picture.

There is probably no chemical substance left on the print that is likely to injure the gelatine picture, but a little oxalic acid (about 30 grains) added to 40 ounces of the alum bath will remove any chromates that may possibly not have been acted upon by the acetic solution.

CHAPTER XI.

The Gum Bichromate Process.

Mr. James Packham's outline of the process is as follows:—

Papers Suitable for the Process.

For the practical working of the process, the first considerations are the selection of a suitable paper, the character of the subject, and the effect desired.

There are numerous kinds of paper at our command, all of which give varying results. Most papers that absorb the bichromated solution, and are of a deep orange tint when dry, may be relied on to work efficiently, if they are not absorbent, and do not allow the pigmented gum to become too intimately associated with their fibres. Where softness and not too brilliant high lights are desired, however, a certain amount of absorption of colour is sometimes an advantage. Those papers which are heavily sized, especially if with gelatine or starch, give purer white, much detail, and a tendency to hardness. These opposite qualities are the mediums by which the varying and charming results of this ductile process are obtained.

The following are a few of the more easily worked papers, a selection of which will give a wide range of effect. They are easily procurable from most artists' colourmen, and are not expensive.

Michallett paper is a fairly heavy paper, of the kind known as "laid," with distinctive markings. It is rather coarse in texture, with a series of fine lines running in one direction, set closely together; another set of lines—much wider apart and very distinct (almost inconveniently so)—run at right angles to these. But, altogether, it is an easily worked paper, readily absorbing the bichromated solution, and taking an even and thin coating of the pigmented gum.

Allongé is a rather heavy paper, apparently of the kind known as "wove," without water markings. This paper has one side which is of a delightfully fine and even grain, and is in every way adapted for this process.

Lallane is a much lighter paper, partaking somewhat of the character of Michallett, but much more delicate in its markings.

English cartridge paper works well, and has also on one side a semi-fine grain, similar to allongé, but, as it is rather heavily sized, the resulting prints tend to hardness, although good and clear high lights are obtainable.

Whatman's papers give excellent results, and the coarser kinds are well adapted for very broad effects.

With the advantages securable by the proper chromatising of the paper, there are now a host of others that are equally well adapted for this description of work. Fine, glazed-surface papers are difficult to manipulate, but, when skill has been acquired, they can be advantageously employed in some cases. It will be found that most of the papers used for water-colour drawings have two distinct surfaces, which are open to selection, the toothed or grained side being the one on which it is the more convenient to work.

SENSITISING THE PAPER.

Having selected a suitable paper, we may now proceed to sensitise it, or, in other words, completely saturate it with a solution of bichromate of potassium. The solution must be of the strength of one part of the salt dissolved in ten parts of water. The saturation must also be complete, and it is most conveniently accomplished if the paper be worked into quarter sheets. It is advisable, before cutting it into quarters, to mark each corner of the full-sized sheet on the opposite side to that which is intended to be worked upon, so that corresponding surfaces may be easily distinguished at the time of coating.

The solution of bichromate, being so nearly saturated, has a tendency to crystallise out in the stock bottle. When such is the case, it is advisable to raise the temperature of the soluble portion and redissolve the crystals therein. It will be found that all papers, especially those which are heavily sized, are more evenly saturated if the operation is carried out at a temperature of from 60° to 70° Fahr.

Two minutes have been given as the required period for steeping the paper, but this is not at all times sufficient, because, if the solution does not evenly and thoroughly permeate the paper, it will be unevenly absorbed during the time of drying, or uneven printing will result.

Having decided how many quarter sheets you propose to sensitise, pour into an ordinary deep developing dish sufficient bichromate solution to cover the whole of them. Then take each sheet separately and immerse it below the surface, carefully removing all air bells; turn over, and do the same with the reverse side. Mark the first sheet distinctly on the back to distinguish it as the first to be immersed, and leave the marked side uppermost. Go on working in the same manner until you have immersed all you intend to sensitise. Then proceed to remove the bottom sheet to the top, at the same time examining it to see there are no air bells remaining. Continue this proceeding until the whole of the paper is completely saturated, and the first sheet immersed is at the top. Now raise each sheet slowly by one corner, and very gradually remove it from the solution. This will free it from all superfluous liquid. The paper is now pinned by one corner to a shelf, or hung on a line to dry, one corner downward, there being attached to the lower corner an inch or two of bibulous paper by its own adhesion.

The drying must be completed in darkness or yellow light, and from now the paper must be carefully shielded from actinic light and from dampness.

Paper thus prepared can be kept for a considerable time, unless it be heavily sized. The deterioration of prepared paper is recognised by its change of colour from a bright yellow or orange to a dirty-greenish brown.

There are other means of using the bichromate salt, which will be explained later.

THE GUM MUCILAGE AND PIGMENT.

The next procedure will be the consideration of the gum mucilage we shall employ. There are several kinds of gum, but only one description appears to be adapted to this process with any certainty of success. This is the Soudan gum acacia, known as Turkey, and it should be purchased in tears, never in powder. Dissolve this for a stock solution in the proportion of four parts of gum to ten of cold water. If broken in small pieces, it will, if occasionally stirred, all be melted in one evening. Strain out the woody impurities through fine muslin, and allow others to subside in the stock bottle. A convenient quantity to work with is two ounces of gum dissolved in five fluid ounces of water. This should be well corked in a rather wide-mouthed bottle.

Thus far we have sensitised our paper and prepared our mucilage. We have now to select and combine our pigment, and to coat the paper with the resulting mixture. These two processes appear to have been the difficulties over which many who have attempted to work in gum-bichromate have stumbled. But there is no reason why the difficulty should exist. It is merely a matter of a little technical skill and strict adherence to uniformity of working with constantly known quantities. I would advise that none but dry colours be employed. They are easily handled, and you then always know the characteristic behaviour of your colloid. So many and various are the mediums in which the tube and other water colours are prepared that, when using them, the results are uncertain, and it is also difficult to work with accurate proportions of pigment when in the form of paste or cake.

A useful selection of powdered pigments will be vegetable black, red and yellow ochre, burnt sienna, and burnt umber; with these any combination tint may be made up.

It is advisable always to work with accurately weighed and measured quantities, and to book your various formulæ. You will also find it a great convenience to number each combination, taking a piece of coated paper, printing a portion of it, and developing it, leaving about half of it plain white, upon which to note the number of the formulæ or other valuable particulars. By so doing, you can at any time produce duplicates in the exact colour, or make such alterations as are advisable.

To combine the gum and pigment, take half a fluid ounce of four in ten gum mucilage, to which add half a fluid ounce of water, reducing the strength to two of gum in ten of water. Thoroughly mix this. I will explain later why I keep the mucilage of double strength.

Weigh out twelve grains of vegetable black, and place upon a marble slab or plate of ground glass; about twelve inches by twelve inches is a convenient size. Upon the small pile of pigment drop a few drops of the mucilage, and with a palette knife carefully grind and regrind the mixture until it is in the finest possible condition. This will occupy about five or ten minutes, and much of the range of scale in the gradation of your print is dependent on this operation. Take this up with your palette knife, and transfer to an old teacup, and pour more of the gum mucilage upon the slab. With a little practice this may be made to completely clean it free of all the remaining pigment, which is now added to that already in the cup, upon which pour the remaining portion of gum, and work it well up with your coating brush.

COATING THE PAPER.

The coating brush most convenient for use is of the kind known as a two-inch bear's-hair set in tin.

To coat the paper, place upon a drawing board of soft pine wood a sheet of demy size, thick blotting-paper, in two thicknesses. Upon this, pin down at each corner a quarter sheet of your already bichromated paper, which must previously be made absolutely "bone" dry, with the side you have previously marked downward. Do not drive your drawing pins home. Mix your pigment and gum mucilage again by repeatedly filling your brush and scraping the colour out on the side of the cup. Take a fairly full brush of colour, and spread it evenly over the paper, crossing and recrossing it with the brush once or twice.

You will now find your paper has expanded considerably. Remove the drawing pins singly, stretching the paper slightly; as you repin each corner down again, you will have an even, level surface. Now take a four-inch flat, badger's-hair brush, known as the artists' "softener." Hold this brush vertically by the two fingers and thumb, about an inch and a half from the top of the handle, and proceed to pass is over the surface of your paper as quickly as possible, again and again, until it is nearly dry, and absolutely and evenly coated with a thin, semi-transparent coating of the pigmented gum. It is impossible to describe the peculiar motion which spreads the mixture in the best possible way. It is entirely a wrist action, not very gentle nor yet very heavy. The brush is not passed over the paper in the usual manner; it is a kind of hop, skip, and jump motion, with the fiddler's rapidity of action when he is executing demi-semi-demi-quavers, and can only be acquired by practice, but it is very effectual in obtaining absolute uniformity.

Undoubtedly many failures have been the result of the employment of far too much pigment. It is remarkable how little is required. I have secured admirable results with seven grains of vegetable black mixed with one fluid ounce of the diluted mucilage, and I seldom, even when the most dense shadows are required, use more than double this quantity. As previously stated, every degree of tint can be obtained by a mixture of the before-named colours. The ochres and umbers, sepia and siennas, must be used in quantities ranging from thirty-five to forty and even fifty grains to the fluid ounce of gum.

To test if the paper has been correctly coated, cut off a small piece, dry it, and float it, face side downwards, upon cold water. The pigmented mucilage should all freely drop from the surface, or, if not quite clean, should become so with a very slight laving with water, or with the slightest touch of a camel's-hair brush.

The paper, after coating, is best allowed to dry spontaneously; but, if it is intended to be kept for a few days, it must be thoroughly dried by a gentle heat before being placed in the portfolio.

Referring to my observation on keeping the gum mucilage in double the strength required for using, in the first place it keeps much better in the concentrated form, and, again, it is sometimes useful for working by the old method—*i.e.*, to mix half a fluid ounce of the strong mucilage with half a fluid ounce of one in ten bichromate solution, and coat any of the papers plain without previous sensitisation with this, after having mixed it with the desired pigment.

Exposure and Development.

Exposure, as previously explained, depends greatly upon the intensity of the light. The printing should be done in bright, diffused light, but not sunlight; and, as a rule, two or three gradations of a Burton's actinometer will be found sufficient upon not too heavily coated paper, employing the back or yellow side of a strip of the actual paper you are printing upon as an indicating medium. Red-toned pigments and browns require more exposure than blacks. Nothing but actual practical experience can teach the exact extent to which it is to be carried. The exposure also can be considered complete when the principal shadows are fairly evident to transmitted light. Over-exposure gives softness, and, if carried too far, completely obscures the half-tones and high lights. With under-exposure the semi-tints are completely soluble.

Development is not a difficult process, but it is open to great latitude of treatment. Place the exposed print face downwards upon a deep dish of cold water, and allow it to float in this manner for five or ten minutes, and then carefully raise one corner. By this time some idea as to what treatment will be required can generally be formed. If the mixture in the high lights and the half-tones has begun to move, the treatment must be very gentle. If none has been dissolved from the body of the print, and the unexposed margins have begun to move, you may consider you have full exposure. In the latter case, allow the print to still float face downwards for another five or ten minutes, or even more, occasionally changing the water, to wash out the bichromate stain. Do not allow the face of the print to touch the bottom of the dish, nor allow it to remain face uppermost, either in or out of the water, unless it be frequently rinsed, or you will possibly develop delightful stains that cannot be removed by any after-manipulation. If the printing exposure has been approximately correct, you should by this time know something about the general appearance of the print.

Remove it from the water, and place it face upwards upon a thin board, somewhat larger than the print. Pin it with one drawing pin at the top to prevent accidents. If under-exposed, very gentle laving with water may remove all the soluble colour, but, if some parts still resist the gentle action of the water, take a large-sized camel's-hair mop, and gently touch those places, beginning upon the margins and foreground. Occasionally flow over the top edge of the print a plentiful quantity of clean water to wash away the dissolved pigment.

The lighter parts of the print will now show up plainly, but the shadows will be still clogged. Deal very gently with the lighter portions, and work on such parts of the shadows and half-tones as may be considered necessary by gently stabbing with the mop brush. Keep the brush continually full of water, and allow a stream to flow occasionally over the whole face of the print. Should there have been clouds in your negative by careful manipulation they may be preserved.

After Treatment of the Print.

We may now presume you have something that may be somewhat like a picture, and now comes the time for those final operations which we are told are questionable photography; well, such treatment may or may not be photography pure and simple, but one must admit that upon the skilful application of the powers of "faking" at this stage depends greatly the making or the marring of all the previous work.

A touch here and a touch there will remove those portions of colour that may not be quite so soluble as other parts, working always by dabbing or stippling with various-sized camel's-hair brushes.

Sometimes the printing may be somewhat overdone in parts, and may require even more patience and power than can reasonably be applied with the brush. If requisite, warmer water may be employed, but it is necessary to be very careful in its application, although it may be used with good effect even up to a boiling-point. At other times a jet of water, either from an enema syringe or from a tube fitted to the household service pipe, is very useful, and this may be applied gently, or with all the force obtainable. In fact, there is no limit to the amount of manipulation that may be utilised, though it must be done in exactly the right spot and in the right degree, for, if the colour be once removed, there is no possible means of legitimately replacing it.

After development to the fullest extent required, there still remains one other operation, if it is desired to clear the print entirely from the stain of the yellow bichromate. This is to pass it through a bleaching bath made up of alum, sulphite of soda, or even hyposulphite, strength being immaterial if the print be well washed for a few minutes after passing through the bath. If the prints have been weakly printed, a weak solution should be used, and one should be certain there is no acidity, and there should be no prolonged washing.

The prints must be allowed to dry spontaneously; do not attempt to apply blotting-paper.

CHAPTER XII.

EARLY PRINTING PROCESSES.

Bingham's Protogenic Manipulation published in 1852 is the source of the details of the following processes:

1. Fluorotype.

A sheet of paper is to be washed, first, with a solution of bromide of potassium, and then with the fluate of soda, or, which will be found the better plan, the two salts may be united. The strength should be as follows:—

Bromide of potassium	20 grains.
Distilled water	1 fluid ounce.
Fluate of soda	5 grains.
Distilled water	1 fluid ounce.

Mix a small quantity of these solutions together when the papers are to be prepared, and wash them once over with the mixture, and when dry, apply a solution of nitrate of silver, 60 grains to the ounce of water. These papers keep for some weeks without injury, and become impressed with good images in half a minute in the camera. The impression is not sufficiently strong when removed from the camera for producing positive pictures, but may be rendered so by a secondary process.

The photograph should first be soaked in water for a few minutes, and then placed upon a slab of porcelain, and a weak solution of the proto-sulphate of iron brushed over it; the picture immediately acquires great intensity, and should then be stopped directly, or the blackening will extend all over the paper; it may be fixed by being soaked in water, then dipped into a solution of hypo-sulphite of soda, and again soaked in water as in the other processes.

We find it is better to add to the proto-sulphate of iron a little acetic or sulphuric acid: this will be found to prevent the darkening of the lights of the picture to a great extent; it will also be better not to prepare the paper long before it is required for use, this being one reason why the picture often becomes dusky on application of the proto-sulphate.

Reasoning upon the principles that the action of light is to reduce the salts of silver in the paper to the metallic state, and that any substance which would reduce silver would also quicken the action of light, we were led to the following experiment: The protochloride of tin possesses the property of reducing the salts both of silver and of gold; a paper was prepared with the bromide of silver, and previously to exposing it to light, it was washed over with a very weak solution of the chloride of tin; the action of light upon the paper was exceedingly energetic; it was almost instantaneously blackened, and a copy of a print was obtained in a few seconds; this was performed last summer. We have lately tried once or twice to repeat the experiment, but without success, the paper being blackened in the dark spontaneously. We hope, however, to perfect a process which gives so much promise.

II. Ferrotype or Energiatype.

Mr. Hunt some little time ago announced a process he then called the Energiatype, from an opinion of his, that the effects produced were not by light, but resulted from a peculiar principle he denominated Energia; he has, however, since altered the name to Ferrotype, which includes all the processes in which proto-sulphate of iron is used as a reducing agent. The original process was as follows:—A solution is prepared by dissolving 2 drachms of succinic acid and 5 grains of common salt in one fluid drachm and a half of distilled water, having previously added half a drachm of mucilage of gum arabic. This is applied to the paper, and when dry, is to be washed over with a solution of nitrate of silver, containing 60 grains to the ounce of water; it is allowed to dry in the dark, after which it is fit for use. It may be preserved in a portfolio, and placed in the camera when wanted. The time necessary for exposure varies from two to eight minutes, but like the calotype no image is at first visible. In order to bring out the latent picture, it is necessary to wash it with a saturated solution of proto-sulphate of iron, to which has been added 2 drachms and a half of mucilage of gum arabic; we find it is an improvement in this process as well as in the Fluorotype, and, indeed, in all cases when the proto-sulphate of iron is used, to add to it a little acetic acid.

It is not essential to use the succinate of silver, for Mr. Hunt finds that the picture may be produced either with the benzoate, the bromide, the iodide, the arseniate, or, indeed, nearly any one of the salts of silver. The proto-sulphate of iron has this advantage, that pictures may be produced much more quickly by its means than by any other method; when used instead of gallic acid in developing an ordinary calotype picture, the quickness is extraordinary, and engravings, etc., may be copied absolutely instantaneously.

Mr. Hunt has modified this process in a very ingenious way; he has taken advantage of the property possessed by the oils of cassia and of cloves in precipitating metallic silver, as in Drayton's process for silvering mirrors, but he finds that the silver will be precipitated more readily upon those parts where the light has acted. The following is the process:—

The paper, after having been submitted to the influence of light, is immersed in spirits of wine containing in solution a small quantity of the essential oils of cassia and of cloves, and as soon as the spirit has penetrated the paper, it is to be pressed between folds of blotting paper previously saturated with the same solution, and then pressed together between two pieces of plate glass; in the course of an hour or two the picture will be developed very beautifully, and may be fixed in the ordinary way.

III. Chromotype.

This is another process for which we are also indebted to Mr. Hunt, and it has this advantage, that it is a positive process; that is, a copy of an engraving is produced at once, with the lights and shades correct; it is also one of the most simple and easily managed, and the pictures produced are very beautiful. The process was made known at the meeting of the British Association, August, 1843. We give Mr. Hunt's description of this process.

One drachm of sulphate of copper is dissolved in half an ounce of distilled water, to which is added half an ounce of a saturated solution of bichromate of potash; this solution is applied to the surface of the paper, and, when dry, it is fit for use, and may be kept for any length of time without spoiling. When exposed to sunshine, the first change is to a dull brown, and if checked in this stage of the process we get a negative picture, but if the action of the light is continued, the browning gives way, and we have a positive yellow picture on a white ground. In either case, if the paper, when removed from the sunshine, is washed over with a solution of nitrate of silver, a very beautiful positive picture results. In practice it will be found advantageous to allow the bleaching action to go on to some extent; the picture resulting from this will be clearer and more defined than that which is procured when the action is checked at the brown stage. To fix these pictures it is necessary to remove the nitrate of silver, which is done by washing in *pure* water; if the water contains any muriates the picture suffers, and long soaking in such water entirely destroys it, or if a few grains of common salt are added to the water the apparent destruction is very rapid. The picture is, however, capable of restoration, all that is necessary being to expose it to sunshine for a quarter of an hour, when it revives; but instead of being of a red colour, it becomes lilac, the shades of colour depending upon the quantity of salt used to decompose the chromate of silver which forms the shadow parts of the picture. We find that, by substituting sulphate of *nickel* for the sulphate of *copper*, the paper is more sensitive, and is more clearly developed by the nitrate of silver.

Mr. Hunt has since modified this process—we give his account: "A neutral solution of the chloride of gold is mixed with an equal quantity of the solution of bichromate of potash. Paper washed with this solution, and exposed to light, speedily changes, first to a deep brown, and ultimately to a bluish-black. If an engraving is superposed, we have a negative copy, blue or brown, upon a yellow ground. If this photograph is placed in clean water, and allowed to remain in it for some hours, very singular changes take place. The yellow salt is all dissolved out, and those parts of the paper left beautifully white. All the dark portions of the paper become more decided in their character, and, according as the solarisation has been prolonged or otherwise, or the light has been more or less intense, we have either crimson, blue, brown, or deep black negative photographs."

IV. Chrysotype.

This is a process discovered by Sir John Herschel, in which iron and gold are used as photogenic materials. Good paper is to be washed with a solution of the ammonio-citrate of iron, dried, and afterwards washed over with a solution of ferrosesqui-cyanuret of potassium. This paper should be dried in a perfectly dark room, when it will be ready for use in the camera. After it has been exposed a short time, the picture may be developed by washing it with a neutral solution of gold, of such a strength as to appear of the colour of sherry wine; the image instantly becomes visible, and may be fixed by being well washed in water, dried by blotting paper, and then again washed in a weak solution of the iodide of potassium. Should the picture not have been well washed previously to the application of the iodide of potassium, the lights will become discoloured, but will speedily whiten again spontaneously.

Breath Printing.

A very interesting and curious process was discovered by Sir John Herschel, by which latent pictures can be produced, which are capable of being developed by the breath, or by a moist atmosphere. If solution of nitrate of silver, specific gravity 1·200, be added to ferro-tartaric acid, specific gravity 1·023, a precipitate falls, which may be again nearly redissolved by a gentle heat; a yellow liquid is obtained, in which further addition of the nitrate causes no turbidness. When the total quantity of the nitrate solution amounts to one-half the bulk of the ferro-tartaric acid, it is enough. The liquid so prepared does not alter in the dark. The paper is to be spread over with this solution and exposed wet to sunshine (but partially shaded); for a few seconds no impression seems to be made, but by degrees, although withdrawn from the light, it develops itself spontaneously, and at length becomes very intense. But if the paper be thoroughly dried in the dark, it possesses the singular property of receiving a dormant or invisible picture, to produce which (if it be, for instance, an engraving which is to be copied) from thirty seconds to a minute's exposure to sunshine is requisite. It should not be continued longer than that time, as not only the ultimate effect is less striking, but a picture begins to be visibly developed, which darkens spontaneously after it is withdrawn. But if the exposure be discontinued before this effect is produced, an invisible impression is the result; to develop which it is only necessary to breathe upon it, when it very speedily acquires an extraordinary intensity and sharpness, as if by magic. Instead of the breath, it may be subjected to the regulated action of aqueous vapour, by laying it in a blotting-paper book, of which some of the outer leaves have been damped by holding them over warm water.

I have been obliged by the exigencies of space and other considerations, to cut down this article to about half the length to which it originally extended. I must therefore hold over much matter for inclusion on a future occasion. I hope that the present instalment will have the effect I most desire, that of stimulating interest in many neglected processes of the past, and in others of the present which are not so much practised as they deserve to be.

AMONG THE CONIFERÆ IN KEW GARDENS.

By J. H. Baldock, F.C.S.

Moons may wax and moons may wane, but the "British Journal of Photography Almanac," like the mighty river, flows on for ever, and my humble little article comes but as a small tributary to be speedily swallowed up in the vast bulk of the rolling waters. I need offer no apology for the subject I have chosen for my contribution to the Almanac of 1904, because the trees and shrubs forming the coniferæ and taxaceæ are so beautiful in themselves, are, moreover, evergreens, and so many persons possess such magnificent collections of them, that they stand, as it were, in a special class by themselves. In Kew Gardens, where I obtained my photographs, there is a very fine collection, extending altogether for a distance of over two miles, between

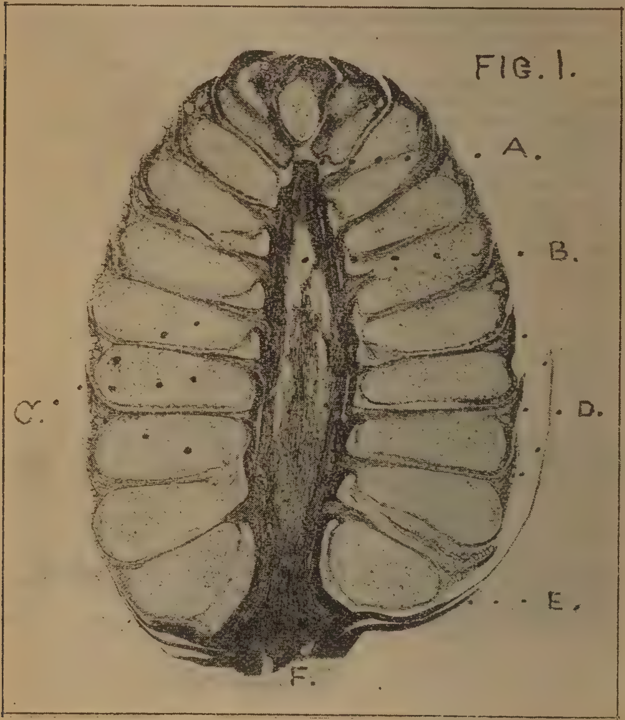


Fig. 1.

a. Growing point. *b.* Central stem. *c.* Pollen grains. *d.* Apex of staminal leaf. *e.* Bract. *f.* Enlarged base of attachment.

the large lake and the Queen's Cottage. This cottage and the surrounding land, have recently been added to the Gardens, increasing their extent from 251 acres to 288 acres. In these two miles are collected something like 1,200 *named* specimens, and almost every variety that can be grown in the open air in this country is represented. In photographing, be sure your specimen *is named*, otherwise you may be in doubt as to what it really is, and lose much time in finding out,as happened to me some two or three years ago, when, after taking a very fine tree, I could not find its name, and it took me half the day (I was taking other specimens at the same time, of course) before I came across a similar tree in another part of the Gardens.

FIG. 2.

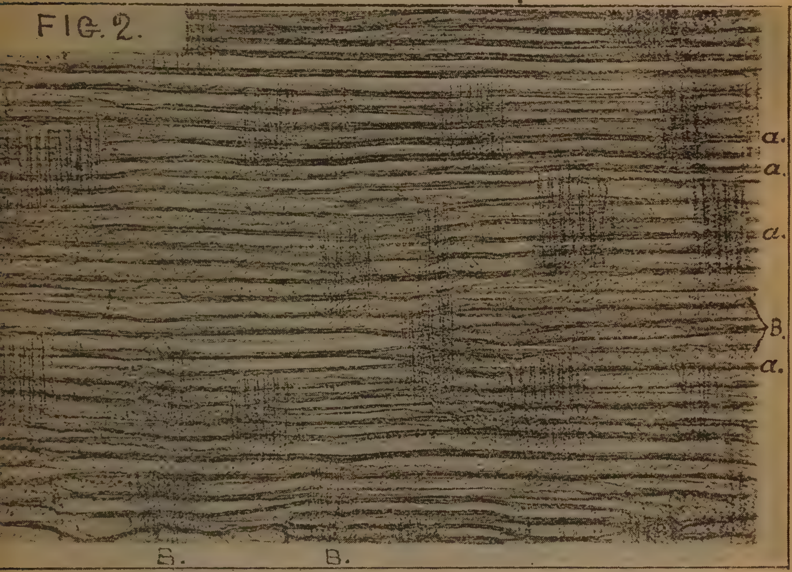


Fig. 2.
a. Bordered pits, or pitted cells. *b.* Medullary rays.

The name "Coniferæ" is derived, of course, from the fact that the fruit of these trees takes the form of a cone, which is so well known to everyone, and the cones are often used for making baskets and other ornaments. In Fig. 1 is seen a section of one of these cones—*i.e.*, that of the Pinus Sylvestris—which forms a very good type of the order. These cones differ exceedingly in size, those of Larix Americana being about half an inch long, while those of Pinus Lambertiana are often two feet. Again, several cones of Tsuga Canadensis (hemlock spruce) are required to weigh one ounce, while a single cone of Pinus Coulteri often weighs from four to five pounds, or even more.

Another very characteristic structure in the conifers, though not entirely confined to them, nor found in all of them, is what is known as the pitted tissue, consisting of bordered pits, the formation of which is foreign to the object of this article, but is well shown in Fig. 2, in which is seen the "bordered pits," traversed by the medullary rays. Another very distinguishing and important characteristic of the coniferæ is the resin ducts, which contribute so largely to the commercial value of the timber of these trees. These ducts are most conspicuous in the summer wood of the outer annual ring, as may be seen at A, Fig. 3. These ducts run parallel with the stem, and are filled with turpentine, which ultimately, by exposure to air, becomes oxidised into resin. The greater the quantity of this resin present, the greater is the specific gravity of the wood, and the more valuable it becomes for timber or as a source of resin. The elasticity of the wood of the conifers is extraordinary, and it is consequently much employed for certain parts of the piano and violin.

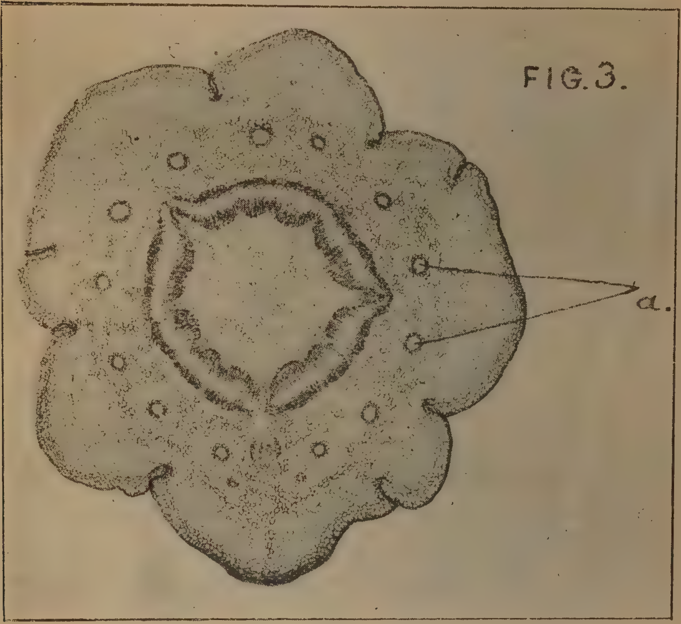


Fig 3.

Its durability, too, is well known, and the higher the gravity the more durable, as a rule, it becomes.

Enough has now been said about the characters which distinguish the conifers, for which purpose it was necessary to employ photomicrographic illustrations, so that the more ordinary form of photography may now be referred to. These trees often grow to a very great height, and consequently it is difficult to get far enough away from them to properly include the entire tree, in which case it would probably be the best plan to select a young tree which shows well the characters of its species. It is also, perhaps, even more difficult

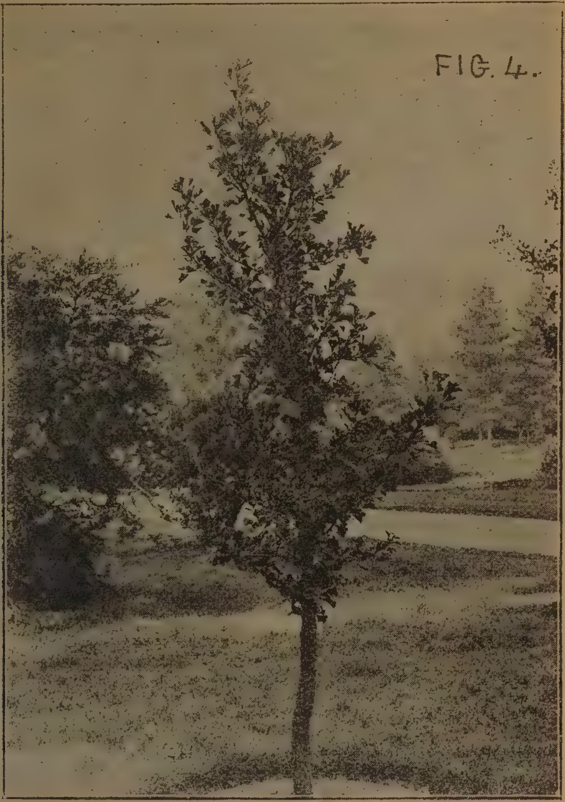


Fig. 4.

to isolate the tree you want to photograph, from its surroundings. In this case get the best view you can of the particular tree, and use as large a stop as possible that will well define that tree; all the rest will be more or less out of focus. Another advantage of employing a large stop is, of course, that a shorter exposure is necessary, and the very possible effect of wind reduced to a minimum. This, in the case of Kew Gardens, is especially valuable, as lying so close to the river as they do is, I suppose, the cause of there being nearly always a disturbing wind there—indeed, I have stood with cap or ball in hand for fifteen to twenty minutes before I could get a tree or

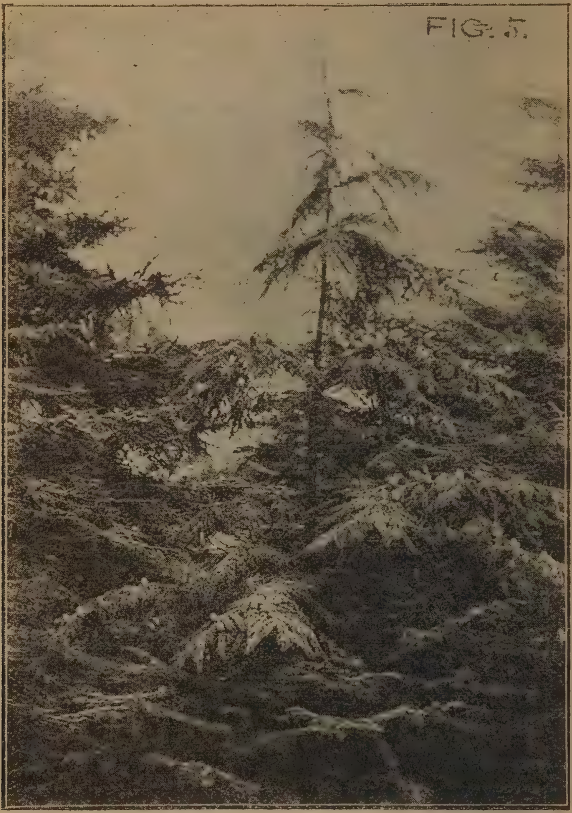


Fig. 5.

branch quiet. It must be remembered, too, that conifers are evergreen, and that their characters depend so much on their leaves, cones, etc., that it is useless to wait for the fall of the leaf, as can be done with other trees.

At the present time, a group of trees or shrubs which were once included in the coniferæ are separated from them under the title of taxads, of which the Irish yew (Taxus Baccata) is a well-known example, a marked distinction being the fruit, which greatly resembles a drupe, such as is seen in the plums. I only refer to this order for the sake of illustrating one tree which is included in it—viz., the maidenhair tree (Ginkgo biloba), a young specimen of which is seen in Fig. 4. This tree is monotypic, and is the sole survivor of a number of others of unknown antiquity, carrying us back to the geological times when the Icthyosauri and Dinotheriums flourished, ages before the appearance of man on the earth. It grows to a height often of 100ft., and attains to an unknown age. The Chinese and Japanese have for centuries associated it with their religious worship, planting it near their temples. A fine specimen may be seen in Kew Gardens, near the Fern House. The exposure for this

FIG. 6.

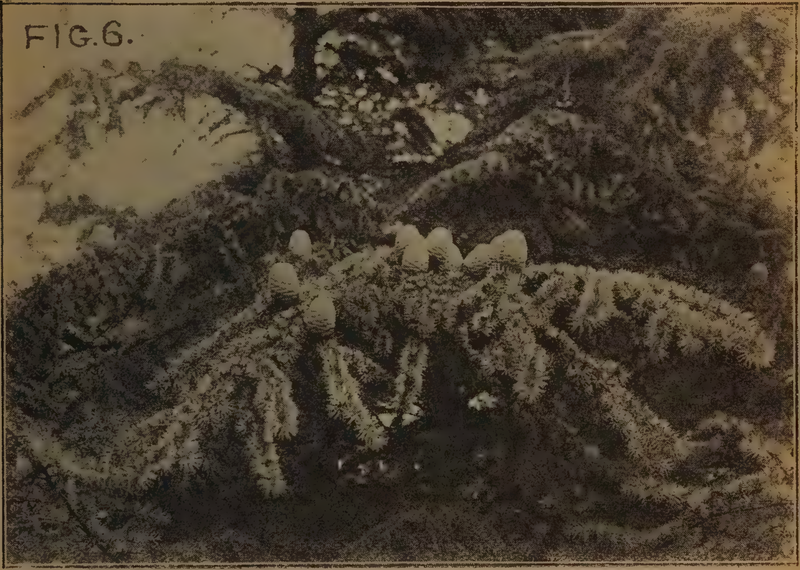


Fig. 6.

was four seconds, *f*32, very bright, at 2.50, September 17, 1903, on an Imperial ordinary backed plate.

Among conifers proper, few can compare with the stately beauty of the Cedrus Atlantica. The Cedar Avenue, as it is called, stretching from the Pagoda to the Lake in Kew Gardens, contains a number of these beautiful trees, while very fine examples occur in many other places in the Gardens. It attains a height of 80ft. to 100ft., and when full of cones, as seen in the illustration, is a striking object.

This photograph was taken in September of the present year (1903), and represents the entire tree as taken with a seven-inch lens, while Fig 6 represents a fruiting branch, easily recognised, from the same tree, taken on the same day, but with a nine-inch lens, and at closer quarters. The exposure for these was six seconds at *f*32, on September 17, between 12.30 and 12.45, the light being bright, on Imperial ordinary backed plates, developed with their pyro soda formula.

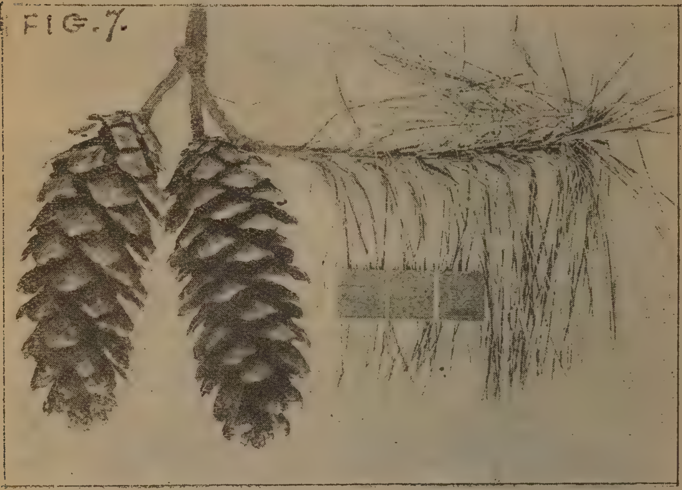


Fig. 7.

In conclusion, I may make a brief reference to the leaves of the coniferæ, which to the ordinary observer present a very similar appearance, but on closer inspection are seen to differ widely. Many of them, it is true are very long and thin, needle-shaped—omitting, of course, the fern-like leaves of the Ginkgo—but even among these, it will be observed, there is a great difference, some being much longer and thinner than others, and their arrangement round the stem and their grouping are also different. But this is more a botanical question, and the idea may best be seen in the two accompanying illustrations, where, in Fig. 7, we have the leaves of the Pinus excelsa, which are arranged in little groups of five, surrounded at the base by a brown sheath on either side of the branch; while in Fig. 8 is seen quite a different arrangement of the leaves, which are clustered together, and, as will be noticed, not in groups of five, but three, each three having a little sheath as before mentioned. The point to observe in photographing these leaves is so to arrange them that they show each their own peculiarities. The last two illustrations also show well the great difference existing between the cones.

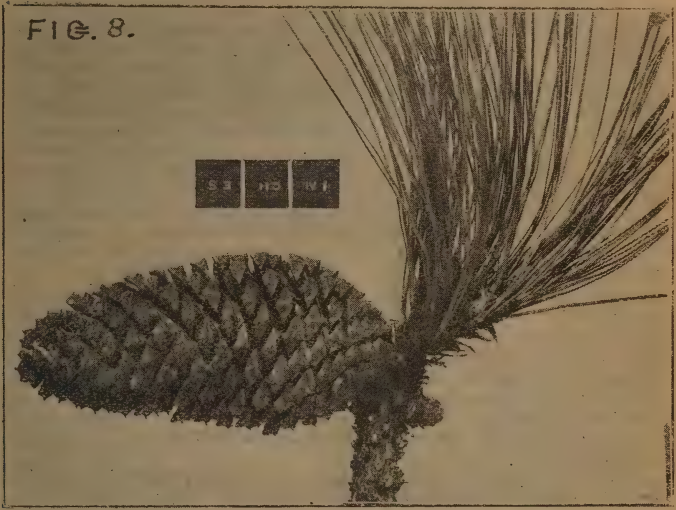


Fig. 8.

The three first figures illustrate photo-micrography, either without a microscope or as low-power work. The next three figures represent ordinary outdoor work. The last two figures were taken by the vertical method described by me in the "Almanac" for 1902, p. 755, and the subjects were placed on glass, the exposure being one minute at *f*45, good light, and Imperial ordinary plate. Given the material, which is not difficult to obtain, most of this kind of work can be done in the house, and therefore to a very large extent independent of the weather, avoiding, as stated in that article, a *top* light, using only a front light with a reflector behind the object, to illuminate the dark side, and it seems to me that much more valuable results might be obtained if a little more attention generally was given to such scientific work as this, instead of accumulating hundreds and thousands of so-called picture subjects, which are soon relegated to obscurity. With this idea in mind, I have ventured to write the above for the "British Journal Almanac" for 1904.

SPECIALISM.

By Frederick Graves.

Whatever one may say of the limitations of photography, there is practically no limit to the enormous field of its potential operations. Is it not surprising that the amateur does not strike out more frequently from the well-trodden paths of general snapshotting, and betake himself for a change along the less frequented and often more interesting bye-roads that the various departments of our work open up to him? The newcomer to our ranks often wearies after a short attempt to tackle everything around him. Often and often do we see him evince his failing interest in the pursuit by throwing up his pastime, and disposing at a sacrifice of the apparatus upon which, but a few short months before, he spent so much money.

I have many times thought that, could some of these disenchanted workers but have their feet guided into the off-lanes of specialism, they would, in many cases, find speedily a cure for that depression at the want of success that comes of attempting too much, and, instead of being utterly disillusioned, would grow into enthusiasts.

There are so many roads open; there is so much to be done, and there is almost no limit to what may be done, if it be done well. The fact that photography is looked upon by so many as a hobby is no reason why the work should be scamped; what is worth doing at all, is always worth doing well. But life is so short that no one worker can attempt everything, and do it well. Let us look around, and note a few of the most interesting worlds waiting to be conquered.

There is the ocean, with its studies of rock and wave, its shipping, and its wonderful light, shade, and reflection. Inland dwellers have the ever-changing scenery of the fields and woods, the cornfield, and the barren heath, the woodland glade and thicket; while the town dweller has always curious old streets and houses, fading homes and customs, at his door.

The scientific worker and the naturalist have unlimited scope. The latter may be a collector of butterflies, of shells, of fossils, of birds and eggs, of plants and seaweeds; and in each case the camera will help him greatly, besides augmenting his interest in his scientific hobby. Many of these natural objects have never been properly photographed, many not at all as yet; and there are specimens of the lepidoptera and others of the insect world, many algæ and fungi, mosses and ferns, many shells and fossils, etc., that have never been recorded by photography, and yet would be by no means either too minute or too insignificant or uninteresting.

One worker may take up the photography of fishes, picturing them in their aquarian settings—a most fascinating hobby; another may choose to work at the reptiles—so many of the exotic species of which are fast, alas! disappearing for ever.

I know a botanical enthusiast who has spent some years in photographing the trunks and bark of trees; and in looking over his collection of prints, it is surprising to observe how much interesting information they convey on things that even a botanist might have hitherto not noticed. Then there is architecture, at which already many are working—a most absorbing subject, and one with many pictorial possibilities. We do not expect the man who has made a name in architectural work to give us seascapes, neither do we expect the landscapist to give us skiagrams; each to his own line, though there may be here and there the genius of versatility who can attempt all manner of diverse things, and succeed in all directions.

To attain success, the average man should not cover too wide a field, but constrict the area, and work earnestly. Further instances of specialising might be mentioned, such as flashlight, lightning, cloud, flower, crystal, coin, micro-photography, and so on.

THE ETHICS OF PHOTOGRAPHY.

By A. V. Kenah.

It is probably due to what I was reading a short time ago that my mind got attracted to the direct possibilities of the ethical aspects of photography. I was then enjoying the perusal of Mr. Gladstone's "Juventus Mundi," and had turned to that portion wherein he treats of the ethics of the heroic age. He describes in his own polished style the effects on the mind of the young Grecian of the teachings with which he was imbued by his masters—of the reverence for his parents and all lofty aspirations with which he was educated, and which were the predominant points in his after manhood. We have traced out for us with rare cunning a sketch of Greek life which those who are familiar with the classics must admit stands a wonderfully good chance of being a true and faithful one, and altogether in keeping with the spirit of those times. But you will wonder how such a subject can in any way be connected with our art, yet a little thought will show that what at first appears to be widely separated is in reality closely associated with the inquiry. How often have you had addressed to you the question, "What is the good of all this photography to you?" and how often have you ever paused to inquire, apart from the mere fact of the power of obtaining a number of more or less interesting representations of places you have been to, or faces you are familiar with, whether photography is capable of doing you any good? Yet I am sure that those who have taken up its study earnestly have greatly benefited in many ways by their devotion and zeal.

We commence with the purchase of a camera, and become absorbed for some time in the preliminary mechanical difficulties that beset us, gradually passing through various stages until we find ourselves capable of producing a tolerably good finished print. Even during this period we are gaining knowledge in many ways; it may not be of a profound character, but it is nevertheless useful. We are introduced in a pleasing manner to the wonders of chemistry and physics, and it may be that the acquaintance thus formed will prove so congenial that we will continue to go still deeper and deeper into the inquiries thus stimulated, and adopt this side, to the exclusion of the other. Perhaps, though, while we recognise the necessity of thoroughly understanding certain mechanical operations, we may only regard them as troublesome steps to be got over as soon as possible, in order to leave us a freer hand to grapple with the artistic possibilities which have been aroused in us. We shall find that the pictures which at first pleased us gradually lose their power to charm, and that we become more critical in our judgment of them and conscious of their defects. In our endeavour to ascertain the remedies for our faults we become alive to the fact that we have erred in the composition and other treatment of our subject. Once let us arrive at this stage, with a real desire to progress farther, and we have become a convert whose future success depends on the latent artisticness of our character and the zeal with which we cultivate everything that can stir it into activity.

We buy books on art, and eagerly absorb them; we learn the salient principles of our new hobby, and become able to discriminate between the true and the false renderings which we turn out. In our search after truth we seek those of our friends who are able to help us, and find a new subject to attract us to them; we understand them better, and appreciate them more thoroughly. We go farther. Not content with our living examples we turn eagerly to the picture galleries, and learn to understand why the Old Masters have become so famous, and the real value they are to us of the present generation. At first we shall probably be so confused with the newness of the emotions aroused in us that we will try our hand at every sort of work; but as we make progress we will realise that we are more proficient in one branch than another, and then turn our attention to the more complete development of this aspect. It may be that our natural tendencies lie in the domain of landscape, and that we extract greater pleasure in making pictures of open country scenery than in the representation of still life. On the other hand, our tastes may be all on the side of the more difficult branch of portraiture, and if this be so there is, I believe, hardly a limit to what we may eventually achieve. Just as the Grecian youth progressed from an embryonic start to the perfection of his completed manhood with a greater and greater realisation of the subjective benefits accruing from his objective training, so shall we find that what we first took up in, perhaps, a spirit of scepticism has been the means of arousing in us emotions of which we were unconscious, and of making us develop natural faculties whose possession we were not aware of.

Taken up in the proper spirit, and granted the possession of a suitably endowed mind, photography will do all this and more for us;

and surely the realisation of these powers is of itself sufficient to attract us to its ethical aspects and make us be prepared to defend it against the taunts of its detractors. As we progress step by step in the completer understanding of its powers and limits, so do we discover new possibilities unfolding themselves for us, and learn the real joy of not only overcoming difficulties but also of benefiting ourselves and giving pleasure to others. We become students of the beautiful, and soon perceive that the true, the beautiful, and the good are closely united in the reality of things.

A NINETEEN YEARS' OLD PLATE.

By H. J. Channon.

As there is always a certain amount of interest in facts bearing on the keeping qualities of gelatine dry plates, the following notes may, perhaps, be worth recording. It is well known that much difference has been found in the period during which, under various circumstances, plates will remain in good condition; but in the case of a plate originally of good quality which is carefully preserved, there is reason to believe that this period may be of almost unlimited duration, except, perhaps, when orthochromatic plates are in question.

I do not remember to have seen so long an interval as nineteen years previously recorded, so, having last autumn employed satisfactorily a plate of that age, I think it may be useful to give some details regarding the same. A packet of Wratten & Wainwright's "Instantaneous" quarter-plates was purchased on September 21st, 1883; some of them were used, and the few which remained were repacked in just the same manner as they left the makers, viz., face to face, with films kept from touching by narrow folds of bibulous paper inserted at the ends, wrapped tightly in stout paper, and kept in a dry place. They remained untouched during the space of nineteen years, and, on their coming to light during some experiments which were being made, it was decided to give them a trial.

One tested in a sensitometer having given good results, another was then used in a camera exposure on a landscape subject. It received 10 seconds exposure, with F/26 aperture in a very bad light on an October morning, which I judged would have been about correct for such plates as they were at the time they were bought. They had formerly always given a little chemical fog when treated with pyro—a defect very usual in those days; so, wishing to obtain as clean a result as possible, I developed my negative in a ferrous oxalate solution. The result was really surprising—an excellent negative, as clean and bright as could be expected from a new plate of good quality, free from the dark margins usually considered as signs of stale films, and, as far as I am able to judge, I believe not inferior to the work produced on plates of the same batch at the time they were purchased. Certainly, this plate has well stood the test of time. There still remain three unexposed ones from the same box, which I purpose to expose to the severer test of a considerably longer storage. It may be noted that these Wratten plates have always developed extremely slowly, from which we may infer that the emulsion had been well alumned, and possibly that may have improved their keeping qualities.

In addition to the above, I also came across a Miall plate, which had been eighteen years in my possession, and obtained on it what, for practical purposes, might be considered a useful, plucky negative; but in this case time appears to have acted injuriously to some extent, since an even veil of brownish fog made its appearance. This fog, however, is of little density, and would have no other evil result than to render a little more patience necessary in printing than would otherwise be required. Thus, in one case, nineteen years' interval seems to have left the plate *unchanged*, and in the other the influence of eighteen years has been by no means fatal to the production of a reasonably good negative, so we may assume that, given good plates carefully stored, there is not much need for anxiety as to their age. For my part, when I hear of "*stale plates*," my impulse is always to blame the maker rather than the dealer.

DISCS, GELATINOUS AND SOLAR.

By J. Dormer.

The diluvial experiences of 1903 ought to serve as a solemn warning to photographers that any future opportunity which may present itself of obtaining a portrait of the sun should not be neglected. It is always comforting to possess a picture of an absent friend. Besides, after several months of aquatic weather, tangible evidence of the existence of that luminary serves to dispel growing doubts. The photograph becomes a valuable mnemonic; it encourages the belief that if one's life is sufficiently prolonged, another glimpse may, perhaps, be had of the original; there is even a possibility of its becoming an interesting heirloom. Provided that the sitter condescends to put in an appearance, there is, of course, no particular difficulty in getting such a memento. I obtained mine, for instance, with the aid of the back lens of a 10 by 8 rectilinear, well stopped down, a slow plate, and an old enlarging camera. The last item was needed to cope with the length of focus, and entailed some carpentry at the solar end in order that the lens might be affixed. The diameters of the resulting discs measured half a centimetre apiece —hardly sufficient to show the "rice-grains" which I am told are abundant in the sun, but adequate for memoranda. I observe that in (what, at the time of writing, is) a recent number of the jubilee volume of the "B. J. P." discs of a fifth of an inch are esteemed satisfactory, which corresponds pretty well with the results of my primitive astronomical divagations.

Now for the other discs mentioned above. So usual is it to recommend orthochromatic plates for photomicrography that there is a suspicion of heresy in suggesting that the undyed variety may have a virtue of their own. But with the help of Rheinberg colour discs it is feasible to actinically differentiate some objects from their backgrounds, an advantage which photography with colour-corrected plates would render largely nugatory. Most users of the microscope are now familiar with the utility of these discs of coloured gelatine in bringing out detail and enhancing the beauty of objects. Generally, the effect is apt to be so brilliant, even when the substage condenser is swung aside, that I prefer dulling the field by backing the (differently-coloured) centre with thin white paper, or even using a centre thinly painted with some pigment. By such and other means an illimitable variety of effects is easily obtainable.

As a digression, let me add that intending photomicrographers will find the simplest connection between the camera and the microscope a vertical one. A plain wooden frame can usually be made in which the camera can hang front downwards. This frame will slide on two firm uprights solidly attached to the baseboard, on which the microscope is to stand, in such a manner that the focussing-screen will always be horizontal. The uprights must be a sufficient distance apart to permit of convenient manipulation of the substage fittings. Small blocks or fiduciary marks on the baseboard will enable the microscope to be quickly placed in position, and a light-tight junction of black velvet between the camera and microscope must, of course, be provided. With such an apparatus, assuming that the uprights are absolutely rigid, a variety of photomicrographic work can be satisfactorily accomplished.

WET-PLATES FOR LANTERN TRANSPARENCIES.

By G. T. Harris, F.R.P.S.

Probably at no time in the history of photography has the lantern-slide found itself such a power in the land as at the present time. On all sides it is employed either educationally or recreatively; the professor lecturing to his class illustrates his remarks with a lantern-slide, and the holiday-maker, in the narrower circle of private friends, finds in the lantern-slide a ready means of enlivening his description of the annual holiday. And of the thousands of slides annually produced, it may be safely estimated that 90 per cent. are on gelatine chlor-bromide plates. Why? Simply because such a plate is commercially procurable, of great excellence, and of almost ideal convenience. It stands on a shelf, ready for use at any moment; its manipulation requires no wide departure from methods of every-day practice, and the finished results, when skilfully produced, stand comparison with any other process for lantern-slide work. Such being the case, it is hardly a matter for surprise that the lantern-slide worker of to-day looks upon collodion, either wet or dry, as inconvenient and pre-historic.

Then, again, the gilded photographer of to-day would infinitely rather learn a process of the future than one of the past, even though the knowledge was harder to acquire, and the results distinctly inferior. To learn wet-plate photography would be to turn one's face backwards, despite the fact that no finer course of technical training could be imagined than to attain excellence in making wet-plate transparencies. Two years ago the prospect of a long spell of lantern-slide work induced me to decide for my own satisfaction the relative merits of gelatine and collodion for lantern-slides. The processes tried were gelatine chlor-bromide (of home preparation), collodio-bromide (washed emulsion of home preparation), and wet-collodion. About three months' work was devoted to each process, so that complete familiarity might be attained with each. The result of my experience was altogether in favour of wet-plates when continuous work in lantern-slide transparencies is probable. I found that it was infinitely easier to procure a high-class slide with wet-collodion than it was with gelatine, that uniformity in results was a marked feature of wet plate-work, and that, even taking into consideration the fact that the plates have to be prepared by the operator, wet-plate work, systematically carried out, is much more expeditious than gelatine. Collodio-bromide combined the convenience of the gelatine plate with the certainty and crispness of the wet-plate. The process is too well-known as an ideal lantern-slide process to need any eulogium at my hands. The neglect that has overtaken it is wholly unmerited, as it probably stands unrivalled for excellence. At the present time I find it difficult to give a satisfactory reason for my preferring wet- to dry-collodion as an everyday working process; probably the wet-plate is the more expeditious, all things considered, and it certainly is difficult to get away from the fact that, with wet-collodion, the particular quality known as "crispness" is got far more readily than with any other process.

Leaving generalities, to consider what may contribute to excellence in wet-plate working, one finds that the collodion occupies premier position. It is probably too much to expect anyone in these post-collodion days to undertake the preparation of batches of collodion, though some advantage may be derived from anyone doing so if a formula specially adjusted for transparency work can be found. The back numbers of the "British Journal of Photography" are a perfect mine of information on the subject of collodion making, and I have tried several formulæ given therein for transparency collodion. I find, however, that ripened negative collodion, if procured from a trustworthy source, leaves little to be desired. My own practice is to procure the negative collodion of commerce, add a few drops of tincture of iodine, and leave it to ripen in a dark and cool place for three or four months before use. Such a collodion gives beautifully clean images of good colour. The silver-bath must be just faintly acid, to secure immunity from veil; if too distinctly acid with nitric acid the images will be unsatisfactory in colour. It is better to have two baths, working them alternately, than to work one continuously. The retired bath should have a little potassium permanganate added to it, and spend its vacation standing in a bright light. With a little care, no trouble need ever be experienced from the silver-bath. Of course, care will be given to securing its saturation with iodide before commencing work.

There is no question about the value of an organifier in the developer if good warm colours are desired. I do not think that anyone who has once used an iron developer, plus an organifier, for transparency work will afterwards remain content with the unsophisticated solution. The least "forcing" of development must be avoided in wet-plate transparency work if images free from veil are desired; the exposure should be generous, so that the image develops easily to full density in about half a minute, and yet not so prolonged as to cause any deposit to cover the highest lights. I rarely find any necessity for intensification, nor yet for toning afterwards. If the collodion and bath are each in perfect condition the colour, with a good negative, will be an agreeable chocolate brown, requiring no further treatment. But in lantern-slide work, no less than in other descriptions of positive work, a good negative is essential to a good result; a thin, flat negative will never give the result that can be obtained from a negative of good destiny, either as regards crispness or colour.

Wet-plates lend themselves to toning operations in the readiest manner; but I have such a bias in favour of obtaining colour by development, that I fear any remarks from my pen on the subject of toning will lack force. Toning operations disturb the opacity of the slide to a greater or less degree, and on drying, a slide that looked full of quality when wet will be useless from depreciation of image. Platinum still stands as the most convenient toning agent, but I find it slow if used according to the formulas of the textbooks. I make up much stronger solutions than are usually given, and employ them hot, by supporting the bath over a gas ring during toning operations. Mercuric chloride, followed by platinum, gives very pleasing tones; the plate, however, requires a good washing between the mercury and platinum. The mercuric chloride may be followed by an application of potassium meta-bisulphite, 30 grains to the ounce, which procures a pleasing brown colour. Sulphide of potassium behaves capriciously in my hands; at times I have obtained extremely fine slides by washing over a slightly under-developed plate with a weak solution of ammonium or potassium sulphide, and on another occasion, under similar conditions of manipulation, I have failed dismally and completely.

I hope sufficient has been said in this short article to induce a consideration for wet-plate work from those lantern-slide makers who are not of the "feather-bed" order. Apart from the excellence of the results yielded by the process, wet-plate work has a charm all its own, and the production of technically perfect wet-plate transparencies brings with it a pride of manipulation that is perfectly justifiable, and a restful satisfaction of which the worker with commercial plates wots not.

THE POSITION OF THE ISOCHROMATIC SCREEN.

By A. Lockett.

Probably the majority of photographers imagine that it is a matter of indifference whether their isochromatic screen is placed in front of or behind the lens. This is by no means the case. To place the screen before the lens is to wilfully deprive ourselves of a definite quantity of available light. There is no difficulty in getting anyone to grant the advantages of a focal plane shutter, as regards speed, and it is, surely, a simple matter to distinguish the close analogy between the shutter and the screen. The question of relative exposure is the same in both instances. The shutter is a device for diminishing the exposure; the screen, likewise, lessens the quality, although not the quantity of the light. The ideal position for both, then, would be just in front of the plate; the second best, behind the lens.

In theory we are asked to believe that light passes in its full strength through the lens, without loss. Unfortunately, this is only another of those many instances where theory does not quite agree with practice. The light does lose in its passage, sometimes quite inappreciably, at others to a decided extent, according to the nature of the refractive elements, the length of time the lens has been in use, and other factors. That being so, it is manifestly a pity to depreciate the quality of the light, at its very source, by passing it through a yellow medium, before it even enters the lens. The latter has, then, to perform its work with an already attenuated and comparatively feeble illumination; whereas, if the screen is placed behind, the lens has the entire benefit of whatever actinic rays there may be, and has practically performed its functions before its transmitted image reaches the yellow screen.

Then, again, all isochromatic screens are not equally perfect. It may be granted that if we are willing to pay for an optically-ground, absolutely transparent piece of yellow glass, there may be no elements of disturbance present. But a large number of workers, nowadays, have got into the habit of making their own light filters, using for the purpose unexposed plates, fixed, washed, and tinted with some suitable dye, or, it may be, sheets of thin, coloured gelatine. Such media are very often not ideally transparent, although quite efficient in their way, and, when used before the lens, necessarily impair to some extent the brightness and clearness of the image. If placed behind, however, this evil is largely discounted.

The most striking example, perhaps, of the different effect produced by the varying position of the screen may sometimes be noticed when one is employed for telephotographic purposes. The indistinctness, and even distortion, occasionally caused when the screen is placed in front of a telephoto lens, contrasted with the perfection of result if used behind, is extremely convincing.

We have said the ideal position for the screen is just in front of the plate. This is, however, seldom practicable. Nevertheless, it may be attained, at any rate with small-sized cameras, and those who have tried it are loud in their praises of the added rapidity and gain in definition thereby secured. We know an example where a tinted celluloid film, placed in the dark-slide, before and in contact with the plate, yielded very satisfactory results. Where the best way is impossible, it is easy to employ the second best, by attaching the screen to the back of the lens, as first suggested. The photographer who adopts this plan will soon be quite persuaded of its superiority to the old way, and filled with wonder that he did not try it before.

A TRIP TO TOURAINE.

By Lieut.-Col. C. Gardner Vatcher.

Having heard so much of its beauties, we went last October to Touraine, so famous for its old chateaux. I do not recommend anyone going so late as we did, as possibly the weather may greatly interfere with camera work, but on the whole we were very fortunate. I suppose the quickest way to get there is via Paris. We went via St. Malo, Le Mans, and made Tours our headquarters. Of course there are other ways of getting there, amongst others via Dieppe, Caen, Le Mans, and Tours. Le Mans, where we stopped the night both going and returning is interesting to English visitors in the fact that its Cathedral contains the tomb of Queen Berengaria, the wife of Richard Cœur de Lion. Tours some four hours distant, is a large town situated on the Loire, and amongst other things worth seeing is the Cathedral, rather difficult to take owing to the narrowness and shortness of depth of the foreground, coupled with the great height of the towers. On market days, as is usual in France, the town is very lively. I got several good snapshots in the vicinity of the markets. The new Hôtel de Ville is well worth a photo, its front is highly decorated with sculptures of large Atlantes or Caryatides supporting the entablatures or mouldings over the windows, porches, etc. Some of the suburbs are worth visiting; electric trams run almost everywhere, making them very get-at-able. By means of one we visited Vouvray, famous for its caves used as dwellings, and for wine making and storing; it is also famous for its Vin Mousseux, or champagne. On the road there, is the old convent of Marmoutier, now a big educational establishment. The Chateau de Plessis-les-Tours, spoken of in Scott's "Quentin Durward," a little way out, now an absolute ruin, is hardly worth a visit. Within easy reach by train is the Chateau de Chenonceaux, dating from the 15th or 16th century. Built in very ornate style on a bridge over the river Cher, it makes a very pretty photograph. It is of interest to English visitors in that Francis II. and Mary Queen of Scots spent their honeymoon ere. Francis I., so closely connected with the chateaux in these parts, at one time resided here, so, apart from its beauty, it is historically famous. Another excursion by train is to the Chateau de Azay-le-Rideau, which, though of no especial interest historically, is beautifully situated on the Indre. A little farther out from Tours, but of interest to English people, is the Chateau de Chinon, really comprising three castles in one, namely, the Chateau de St. Georges, the Chateau du Milieu, and the Chateau du Coudray, is chiefly a series of ruins, parts of which only are in existence. Henry II., of England, built the Chateau de St. Georges. The foundations of the outer walls are the only parts now in existence. Henry also died at Chinon. Another short excursion is to Loches. The chateau is on the top of a hill overlooking the small town, and is remarkable for the great extent of wall, almost in perfect state of repair, surrounding it. In the enceinte is the Eglise de St. Ours, dating from the 10th or 12th centuries. Near this church is the Chateau Royal, in which several of the kings of France have lived. In a small chapel in the building is the tomb of Agnes Sorel (La Belle des Belles), mistress of Charles VII., contemporary with Jeanne d'Arc, and assisting with her in rousing the King to carry on the struggle against the English. The donjon, or keep, is exceedingly interesting, as it contains dungeons in which political prisoners were incarcerated; their inscriptions on the walls are still pointed out. There is also a famous iron cage slung up to the arch of a vault, which Cardinal Balue, its inventor, and Philippe de Comines, the courtly historian, had a taste of, and in it were pronounced to be like trussed chickens. One of the most picturesquely situated chateaux is that of Amboise. about half an hour's train journey from Tours, a famous old Royal castle dating from the 15th and 16th centuries. It now belongs to the Comte de Paris, who, prior to his banishment in 1886, was engaged in restoring it. La Chapelle de St. Hubert, dating from the 15th century, which was restored in the reign of Louis Philippe, is on the same plateau as the castle; its sculptured front is well worth a photo. A pretty general view of the castle can be taken from the opposite bank of the river (Loire) above the bridge. The last few days of our trip we put in at Blois, the gem of all the chateaux. It is a place one can really devote a lot of time to. It is so world renowned that words from me would feebly give expression to its many beauties and embellishments. The best known photograph is that of the courtyard with spiral outside staircase. The interior (restored), is very gaudy, history, of course, playing a part in the descriptions of the many rooms. The Duc de Guise was assassinated in one of the rooms, and Marie de Medicis was confined by her son, Louis XIII. The Chateau de Chambord some distance from Blois can only be reached by carriage. The country is uninteresting, but famous for the wine, and asparagus of which large fields are grown. The chateau is a huge building built by order of Francis I., and is chiefly remarkable in having numberless decorated chimneys, turrets, and pinnacles, and dormer windows. The most famous thing in it is the double spiral staircase so arranged that two persons may be ascending or descending and yet not see each other; this was done to prevent the King from being assassinated. The interior is uninteresting and very unfurnished and unfinished. Our time was limited, or we would have visited several of the chateaux in the neighbourhood. Our return home was uneventful. I would strongly recommend all with a fortnight or more to spare to pay a visit to Touraine.

A PRINTING HINT.

By T. Perkins.

Rough platinum paper, though admirably suited for landscape work and large heads, is not equally well suited for small portraits and work in which fine detail is to be shown, as the grain of the paper when the light falls on it from one side produces shadows which obliterate the detail. A short time ago I had a portrait negative to print, the face being about ¾in. long, but the only paper I had by me was some of the Platinotype Company's CC. As the prints were wanted immediately, there was nothing to be done save to print them on this paper. But when they were dry I felt sure the lady for whom they were intended would not care to see her skin looking as coarse as it appeared on this paper. An idea, however, occurred to me which I carried out, and which gave perfect satisfaction both to myself and my sitter.

I laid the print face upwards on a thick sheet of glass—one of my cutting shapes—and on it laid a piece of the semi-transparent damp-proof paper in which many plate makers wrap their dry plates before packing them in the carboard boxes. Through this I could see the print sufficiently well to distinguish the position of the face and hands, so that I could with the smooth handle of a knife rub down all the parts of the print that represented flesh. The paper that I had laid on the print protected its surface from being scratched and prevented it showing the strokes of the knife handle. When I had finished the result was that the parts of the print which had received this treatment were as smooth and as full of fine detail as if the print had been made on smooth surfaced platinum paper.

This method, as it seems to me, might be employed in other cases, for there are subjects in which we should be glad of fine detail in certain places, while other parts would be better represented if they had that peculiar softness that rough surfaced printing paper gives.

TESTING A SHUTTER.

By Chas. Louis Hett.

The marked speeds of shutters are not always to be relied on. Further, many, even expensive, hand cameras have no indication of the exposure given. Those who use cameras of this type learn nothing of correct exposures, and are quite at sea with any other camera. Hence the importance of a ready method of testing shutter speeds.

I have tried many plans which have from time to time been proposed. Most of these require sunshine, and the results obtained are seldom reliable.

The apparatus which I have found the most satisfactory is a wheel of life. The cost, complete with electric motor and bi-chromate battery, is 8s. 6d. This is not an extravagant outlay, and the wheel itself, when applied to its original purpose, causes a little amusement. I may remark that I use a dry cell, as being less trouble than the bichromate. To prepare for a test :—

1. Affix a small piece of gummed paper to the outside of the drum. This is for the purpose of enabling the revolutions to be readily counted.

2. If the top of the mirror box in the centre of the drum is shiny, cover it with a piece of black calico or other non-reflecting fabric, fastening it down with an india-rubber ring

3. Of stiff, dark-coloured paper, make a cylinder to fit inside the drum, and to stand up some 3 in. above it. This cylinder need only

be pinned together. Mark on this cylinder a series of spirals. Four such spirals will do for a slow speed, but ten is the most generally useful number. In each spiral punch ten holes, about one-eighth of an inch in diameter, so arranged that they are at equal distances round the circumferance.

4. Provide a blackened cardboard screen with a vertical slit about one-eighth of an inch wide. A sheet of white paper completes the necessaries.

For testing, place a table before a window, and lay the sheet of white paper next to the light. Next fix the screen with the slit vertical. The wheel of life is placed in front of the screen with its axis opposite to the slit. Standing back a little, and slowly revolving the drum, the white paper should be seen through each hole in succession as it comes opposite the slit in the screen. The camera may now be set up in the position occupied by the eye, a plate put in, and the wheel started. When it has attained a uniform speed, note the time, as exactly as possible, that it takes to make ten revolutions; then snap the shutter. On developing the plate a vertical line of dots will appear.

Working out the shutter speed will be most clearly shown by an example :—

Data.

10 Revolutions in 13 seconds.
40 Holes in cylinder.
7 Dots on plate.

$$\text{Speed of shutter} = \frac{7 \times 13}{40 \times 10} = \frac{1}{4 \cdot 4} \text{ (nearly) of a second}$$

I afterwards made a disc tester; but, although it possessed some advantages, I do not think that it is so suitable for amateurs' use as that already described.

THE USE OF THE WIMSHURST MACHINE IN RADIOGRAPHY.

By Philip E. B. Jourdain.

In (I think) 1897, two American experimenters arrived at the conclusion that Wimshurst machines are unsuitable, on account of the sectors, for radiography. It may be interesting to quote some details of the experience of the late Mr. James Wimshurst from a letter to me of September 15th, 1898 :—

"For all useful purposes I find sectors *are* desirable; and this is based upon the experience of 15 years with both sectored and sectorless glasses—so much so, that I continue the use of sectors in all my present machines.

"Then, as to combs, brushes, etc., I cannot find better positions, etc., etc., than those I use; and there is nothing, I think, which I have not tried.

"My machines continue to give me and my many friends complete satisfaction in the exciting of the tubes, and I still hold to the thought that, in course of a few more years, they will quite take the place of the coil, with its troublesome contact-breaks, battery, etc.

"You may very well judge this from the fact that in my rooms I have machines 10 and more years old. Nothing has been done to them since new, yet, without a single preparation, and with only three or four turns of the handle, the tube is fully excited; and, when excited, there is no danger of a damaging or dangerous spark escaping to the patient, should the leads become detached or the patient move wrongly.

I find 12 plates, 20 in. in diameter, give very good results. I was showing some electrical experiments with it the other evening, and another friend was showing the X-rays, with a 10-in. coil. I happened, by his wish, to show the difference in result with my machine, and the advantages were so great that my friend would no longer use the coil, and I had to take up my own and his work for the remainder of the evening."

AMATEUR BOOKBINDING, SERVED BY PHOTOGRAPHY.

By Alfred Pumphrey.

As a young man I left bookbinding for photography, and now, after 50 years, am turning back to bookbinding as a recreation. But, finding the lettering in gold a difficulty, I have pressed photography into my service, with results which satisfy myself and others who have seen the application.

Several have asked for information as to my method, and if I was willing that they should use the plan, to which I have responded they were quite welcome to use the plan, and I give the information to your Almanac in case there are others who may wish to use such a plan for books or other purposes where a bold, distinct lettering is required

A white letter on a dark ground is more distinct than a dark letter on a light ground, and is easier produced; but it needs a good vigorous print (somewhat different to an ordinary half-tone photograph), with as great contrasts as possible.

I use white letters an inch in height, such as used for window advertisements, these are not attached to the background of velvet, but displayed, kept horizontal, and the camera is adjusted above the lettering, being made to rise and fall to give the desired size, etc.

A short focus lens is the most convenient, so as to get all the needed adjustments in a small space. I use a doublet 2½ in. focus; this gives a camera movement of about 3 ft., all that I have found needed for letterings from 3 in. wide downwards. For most books a large lettering is not required, that, to economise, I use the quarter of a quarter-plate.

In order to secure a bright, clear negative, I use a slow plate, say, an Ilford lantern-plate; not the very slowest, but the one intended to be used for reproductions in the camera. Developer I use is as follows:—Water, 1½ oz.; sulphite of soda, 60 grains;

hydroquinone, 15 grains; 2 grains of bromide of potassium (made in small quantities, as it will not keep long), equal quantities mixed solution of hydrate of potassium, 90 grains to 5 oz. of water; the mixed solution diluted with equal quantity of water. The negative should be developed till it gives a dense black deposit on the surface, and be seen almost as easily at back as front; this should give dense negative with perfectly clear shadows, fixing, etc., as usual.

The most suitable paper to print on is one with a collodion surface (such as Paget's self-toning). From the class of negative I have indicated, it will give a tone quite as good as an ordinary gold-toned print.

Strong paste is the best medium for attaching the lettering piece to the books; but many samples of cloth, and some glazed leathers, require to have the surface scraped from under where the lettering piece is to go, or they will not adhere. It is well to paste both the book and paper, to rub down well, and bind with a piece of wide tape the lettering piece to the book till dry.

I enclose a photograph showing the effect of books lettered with white letters produced as I have described. There is something to be said in favour of bookbinding as recreative employment. It can be taken up any time; it does not require many or expensive tools. Besides, there is a special pleasure in handling books which are the most human of *things*. If there are any who would desire information as to the work or tools, there is a book, published at 2s. 6d. ("Amateur Bookbinding"), by Gill, London.

MOUNTING P.O.P. PRINTS.

By R. A. Hamblin.

I believe there is more heart-burning caused by the simple operation which forms the subject of this article than by any other in photography. The average worker finds it beyond him, and takes refuge in that abhorred thing, the slip-mount, which is not a mount at all, properly speaking. Perhaps a word or two of advice on the subject of mounting will be acceptable to many of the younger readers of the Almanac. To start with, there are two methods of mounting; the "wet" and the "dry." In the wet system everything is done while the print is absolutely wet. Briefly, the wet print is laid face downwards on a slab of porcelain or glass, and the superfluous moisture rolled out of it by means of a rubber squeegee. The paste is then applied and the print rapidly adjusted to the required position on the mount: a piece of oiled paper is then superimposed, and the squeegee passed lightly backwards and forwards for a few seconds. The oiled paper is then removed, when the print should be found properly mounted. Any paste on the surface may be removed with a wet sponge.

So much for the "wet" system, which is, I believe, the one most in favour at the present moment among workers in P.O.P. It is, undoubtedly, the best process for the "slap-dab" worker, but it has not a few disadvantages. It is messy; it often results in curled mounts which no power on earth can straighten satisfactorily; and last, but not least, the delicate gloss of the P.O.P. seems to be in some way dulled—probably by a weak solution of paste oozing through the tissues of the paper and drying on the surface. Altogether a worker with dexterous hands will be well advised to try the "dry" method, on which I intend dwelling at a somewhat greater length, as it is the least known and practised.

In the first place, don't try and make your own paste. The old-fashioned starch, rarely to be met with in these days of patent stiffening powders, etc., made very good paste for photographic purposes, but the less said about the article figuring as "starch" in the modern housewife's ménage the better. There are plenty of excellent clean photographic mountants on the market which are a pleasure to use, and will really stick. Personally, I prefer the "paste" varieties to the "gums" or "glues."

Secondly, fingers were made before brushes: this truism to be borne in mind when applying the mountant!

Take a rough sheet of blotting-paper, the rougher the better, as it prevents the print from slipping while you are applying the mountant. Place the print face downward on it and boldly dip the fingers into the paste pot, transferring to the back of the print sufficient in your judgment to allow of a thin layer to be spread all over it. Then with the fingers of both hands rapidly spread the mountant, making the movements of the hands in opposite directions, so as not to shift the print. Having covered everywhere, remove any lumps with a sweeping movement to the nearest side, and so off the print, and then go rapidly round the sides once more, to make certain that not even the tiniest area has escaped attention. Now—and now, there must not be the slightest hesitation—lift the print on to the mount, where its position should previously have been indicated by pencil dots. Make certain that the top edge is along the dotted line—the rest of course will be all right. Lay your piece of oiled paper over it, and starting from the centre, give two or three light brisk rolls to either side, followed by some good stiff pressure ones, right across, and diagonally, and round each edge.

By this method the mounts are preserved absolutely flat, the P.O.P. has its delicate surface unimpaired, and what is very convenient sometimes, the whole thing will be absolutely dry in a few moments, and ready for sending away or storing. Half the battle is in applying the mountant, and half the secret in that is to use the fingers rapidly, wiping them, of course, before picking up the print. There is a certain knack, too, in holding the print by the edges so as to avoid conveying the slightest trace of mountant on to its surface.

There is no need for purchasers of most of the ordinary makes of P.O.P. to buy oiled paper, especially for mounting, as that in which the paper is wrapped by the makers will do admirably, and should always be preserved for the purpose. But some manufacturers supply their P.O.P. in a sort of vegetable parchment, which is not suitable. In that case it is better to expend a penny or two on the genuine article than to risk ruining one's cherished prints.

TRANSPARENCIES BY CONTACT IN THE CAMERA.

By W. E. A. Drinkwater.

It sounds a bit Irish, I know, but is exactly what I mean. We generally use the two terms in contradistinction to one another; but I suggest that a combination of the two methods gives far better results than contact in the best of printing frames. Most lantern slide workers are aware of the superior definition obtained by lens and camera work, and it is common to attribute the inferiority of contact prints to unevennesses in the plates of glass themselves. This is likely enough; but, in any case, all feelings of dissatisfaction on the score of definition will be dispelled by using the camera and lens.

In this manner :—Place the negative in the dark slide, instead of a printing-frame, with the film towards you, *i.e.*, the reverse way to the ordinary procedure when loading a dark slide. On the negative place a transparency plate—film to film; close the dark slide, and proceed to expose in the camera. Direct the lens to the sky, or to a piece of white blotting-paper, arranged as a reflector. It is advisable to take precaution that nothing whatever is in focus on the ground glass. The easiest way to ensure it is to rack out the camera to the full extent of the bellows. The smallest available stop should be used, because, the smaller the lens aperture the better the definition. After drawing the shutter of the dark slide, the exposure is made by means of the lens cap. The exposures may be a trifle long, and should be found by the usual method of trial and error, although the use of an actinometer will save many a plate. To ensure working at all times under standard conditions, and thereby lessening the number of factors controlling the duration of an exposure, it is well to always work with exactly the same amount of camera extension, because a shorter extension will shorten exposure very materially, and *vice versâ*.

This method, apparently, demands daylight, and that is not always available at this time of year. But most photographers have at their command the use of an enlarging lantern, and they can adapt it easily for the purpose by putting up a temporary easel in front of the lens at about the same distance as the camera extension would be. In this case an ordinary printing frame can conveniently replace the dark slide, and is placed on the easel in the centre of the disc of light. Stopping down is equally advisable.

It will be at once evident that the method is not only applicable to lantern-slide making. All transparencies for enlarging purposes, and for reproduced negatives generally, should be made this way; also the reproduced negatives themselves.

Transparencies made this way will possess all the good definition of the original negative, even though a cut mask of thick paper be used between negative and transparency plate. In fact, the loss of definition is scarcely noticeable when the negative is film outwards, thus giving a reversed image.

I know this is nothing new, Mr. Editor; in fact, I think I first got the idea from the pages of the "B.J." itself; but a good thing is worth repeating, if it is "practical," and thus conforms to your invitation for a contribution to the Almanac.

FACTORIAL DEVELOPMENT.

By Alfred Watkins.

Folks are a little apt to confuse the two or three different plans of time development. Simple time development assumes (correctly enough) that if, on one occasion you develop to a certain contrast between two stated tones in a subject, you can on another occasion attain exactly the same degree of contrast between similar tones if using the same developer in the same temperature for the same length of time. Even if the subject be a different one, you will know that you will get the same contrast between similar tones.

But factorial development goes a step further. It recognises that the assumption of the same temperature at all times is an ideal not to be attained, and that changes of temperature greatly alter the speed of development, and, therefore, the steepness of contrast attained in a settled time. It, therefore, provides—not a thermometer, but another kind of -ometer, to make the required allowance for changes of temperature, and, incidentally, of other changes of activity of developer from variation of alkali, etc.

This -ometer is an observation of the time a settled tone (the high light) of the image itself takes to appear, as the rapidity of this is an indication of the speed at which the developer works. The relation between this time and the total time to develop is called the factor. The factor varies for different developers, but not usually for different formulæ of the same developer.

As a matter of simplicity, an exposed tone on the negative itself is taken to make the observation of time of appearance. But I have always pointed out that there is an element of unsoundness in this, although the possible inaccuracy has not been a serious drawback in practice. It assumes that the tone observed shall have received somewhere near a standard amount of exposure; and in practice where, on one hand, the observed tone is exceptionally over-exposed (as in the window of an interior), or, on the other hand, exceptionally under-exposed (as where there is really no high light in the subject), it is best to make a mental allowance.

There is a plan which removes this slight imperfection; but it has not gained favour as yet. It is to make an -ometer of a separate slip of plate which has received a standard exposure, and with this to test the activity of the developer, either before it is poured on, or to make a test of a portion while the true negative is developing. The total time is found by factor, as before. With this plan, if it can be arranged to insert the plate in the developer in darkness, and cover it up, a "dark-room light" is not wanted, as the observation of the appearance on the slip may be made in moderate light, as gas-light.

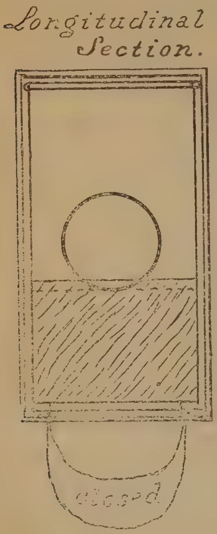
I am inclined to think that the "abolishment of the dark-room" will be more satisfactorily attained by some such plan as this than by the several methods of staining developer or plate which are now before the public. These plans are subject to the same difficulties of getting the plate into the dish, and having to provide additional appliances, as encumber the timing slip method; but the latter provides by far the most perfect control over results.

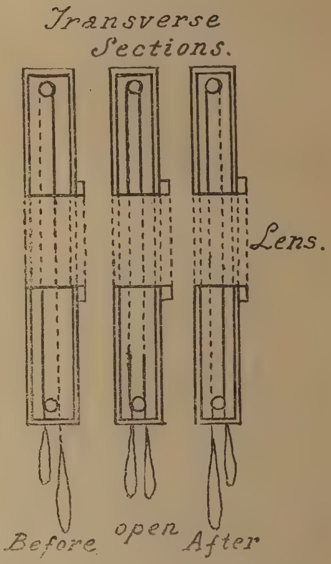
A SIMPLE AND EFFICIENT SHUTTER.

By J. Tilfor.

It has been very justly observed that a correct exposure is essential for the production of a perfect negative; and, with equal truth, that the majority of negatives taken by the average amateur are under-exposed.

The shutter I am about to describe I made more than 20 years ago, and have had it in use ever since with a 7½ by 5 camera, and one for stereoscopic work nearly as long. It is quite fast enough for all ordinary subjects, such as breaking waves, trees in a wind, and street scenes, if there are no rapidly-moving objects near the lens and crossing it.





The case is made of thin mahogany, with circular openings back and front for the lens. An endless band of black velvet, double, passes over rollers top and bottom. In this band there are two openings nearly twice as long as the diameter of the opening in the case, and so placed that the top edge of each coincides with the top of the case openings when the shutter is open. Strings are attached back and front, and pass through the bottom of the case. By pulling down one string the shutter is closed, and then, by pulling down the other, the exposure made, the opening commencing from the bottom, and as soon as fully open, closing from the top, thus giving a slightly longer exposure to the foreground than to the sky. Any exposure longer than the quickest possible can be given and determined on at the moment of making it.

It has been objected to this shutter that it is liable to shake the camera; but with ordinary care and a firm stand I have never found it do so.

POINTS TO AIM AT IN RETOUCHING.

By A. W. Creighton.

1.—Aim at having a good-sized retouching desk; say about 24 by 20 inches, with a revolving centre, so as to be able to turn the negative round when working. The photographic image—or any part of it—is first retouched in an upright position; then, you turn the negative and work across, and around any, or, every part of it, finally finishing the negative in an upright position.

By turning the negative, and working across, and around, different parts of it, you produce a finer effect than you get by working the negative simply in an upright position.

2.—Aim at using the very best pencils for retouching. Hardmuth's Retouching Leads, No. 2, No. 3, and No. 4, are very good, but the leads with the letters on are better. The H., HH., and HHH., are invaluable for doing fine, soft, delicate retouching. The lead in the Kohinoor Pencils is hard, clean, and of superior quality. Once used always used. Far sharpening lead pencils use Oakley's No. 0 glass-paper. You can get sixpenny blocks of glass-paper at Lerchetier, Barbe, Regent Street, London.

3.—Aim at having the negative well illuminated with light. It is absolutely necessary to have, as a rule, a strong, powerful light reflected on the negative in order to show all the lines, spots, and imperfections of the photographic image. This you will get by using a 12 by 10 piece of ground opal glass for a reflector; also, a sheet of white blotting paper is very good. Unless you can see the fineness of the grain of the gelatine film, it will be impossible for you to work up to it, and make your retouching match it.

4.—Aim at a high standard of perfection in retouching, and let your work at all times be distinguished by artistic excellence.

5.—Aim at improving the light and shade of the photographic image of each person. Work over the high lights so as to strengthen them, and give a finer texture; also smoothe the delicate and deep shadows by adding more fineness of texture.

6.—Aim at giving refinement and correct form to face and features. It is most important that the character and likeness of each person—represented by the photographic image—should be preserved. By producing a velvety texture or peach-like bloom on the negative you make the face look refined and beautiful.

7.—Aim at improving the expression of each person represented by the photographic image by making them look life-like and pleasing to the eye and the mind. Remember you look on your negative—not through it—if you wish to see all that is there.

TO CLEAN OLD GELATINE NEGATIVES.

By Horatio Nelson King.

To remove the films from gelatine negatives not required is not a pleasant occupation, a good plan and comparatively an easy one is to have a deep dish or pan according to the quantity required, fill with water as far as necessary, and add 1oz. or more of pure hydrochloric acid to each pint of water, immerse your plates, film side up, one at a time, let them remain for a day or two or longer; if wanted in that time the film will be loosened, and a stiff nail brush will remove the same, rinse off with a sponge and place on rack to drain; do not let them quite dry on the same, but place them on a cloth and rub dry with linen cloth; if allowed to remain and dry, tear-drops very often appear, and are troublesome to remove. A very useful wire draining rack is sold by Marion and Co., to hold 24 1-1, ½ or ¼ plates, and another for 72 also very useful for drying negatives and mounted photos. If you allow your old negatives to remain in the solution for a few days the film will probably be dissolved, and will give very little trouble. The solution may be made stronger and used again. It is advisable to take the plates out by a lifter and place in another dish of clean water to avoid injury to the hands and then finally rinse.

THREE METHODS OF TONING LANTERN SLIDES.

By C. Welborne Piper.

(a) Select a developed, fixed, and washed slide that is appreciably too dense from over-development. Bleach the image in a 5 per cent. solution of either copper chloride or copper bromide and wash. Soak in 5 per cent. potassium iodide for five minutes, wash again, and dry. Then expose to sunlight for, say, a day, so that the image may be uniformly affected by light as far as possible.

The result is very permanent if kept as dry and as carefully as lantern slides are usually kept, but any subsequent soaking in water may alter the tone. The slight moisture from condensation is of no consequence.

(b) Select a slide excessively dense from over-development, and even slightly foggy from over-exposure, but not showing any signs of reversal. Bleach in 5 per cent. ferric chloride solution; wash, first in water acidulated with sulphuric acid until the yellow stain is removed, and then in plain water. Dry, then expose to sunlight until the image is a bright red colour. On the lantern screen the tone is a good full red of a bright tint. It softens down slightly in course of time, but otherwise is very permanent. All red toning processes seem to be liable to change in course of time, but so long as the change is not for the worse that fact is of little consequence. This iron process appears to be as reliable as any red-toning process, and it is certainly far more permanent than some processes in very common use.

(c) Take an exactly similar slide to that used for the last process, and bleach it in ferric chloride, and wash in the same way. When washed, soak in 10 per cent. potassium bromide for five minutes; wash again, dry, and expose to sunlight until the image changes to a deep sepia brown. On the screen the tone is a very near approach to a true sepia. A similar tone can be obtained by bleaching a slide of slightly under-normal density in mercury chloride, washing, drying, and exposing to light without any after treatment with chemicals. The processes are, however, only applicable to slides of quite different character, and the iron process has the advantage of producing much greater transparency in the shadows.

The tones described are those obtained on Thomas's plates; other brands will possibly give slightly different results.

These processes are supplementary to the three "Haloid" processes described in the ALMANACK for 1901, p. 777; the copper iodide process given above being more generally useful than the iodide method of 1901 is to be preferred.

EDUCATIONAL PHOTOGRAPHY.

BY H. D. GOWER.

To the many who may read the above title will probably be inclined to read a little further into the lines, and perhaps wonder what the worthy Editor was doing when he allowed a subject which should be more "practical" to pass and appear in print instead of being consigned to the W.P.B. To adopt the motto, "Sic vos non vobis," is perhaps to be more practical in the present article. By the end of the year all, or nearly all, the education committees throughout the country will be formed for the part they are about to play in the new education scheme, and one wonders what part photography is going to play in this scheme.

* The British Association have appointed a special committee (*i.e.*, the Educational Section) with proposals, and request that corresponding societies should themselves appoint such standing committees for stimulating every branch of inquiry in which these societies are co-operating with the Association, and they further state that the immense benefit that would accrue to the country if the corresponding societies would keep this requirement especially in view, with the object of securing adequate representation for scientific education on the education committees now being appointed under the new Act.

Now, for further reference to the above subject, I would suggest that those who—and I hope all—are interested to get the report for themselves, and read it carefully through. What this question means will at once manifest itself to anyone, and makes it plain that photographers as a body—*i.e.*, clubs and societies, and also individuals—may do a little to help onward in a practical way the education of our youngsters; and to do this it behoves every photographic society or club of any size to keep in touch by some means with those educational committees in their respective boundaries.

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*See Report of Committees of Corresponding Societies of the British Association, Burlington House, London, W.

Once this has been done, the question arises—What the societies are expected to do. Well, it simply means that the work is the promoting of interesting subjects by the aid of photography, and carrying the matter so far as to increase the interest in our work, which will sooner or later yield workers from the ranks of our coming generation; the circulation of lantern lectures upon subjects appertaining to matter and subjects taught in the schools; the circulation of prints illustrating scientific subjects, also the introduction of photography to the students themselves, as an aid to their studies; and, lastly, the help from the different societies, by the collecting of prints and the depositing of such prints with the local governing bodies, that they may be kept in such a way for future reference, recording facts in all branches of science and art—at once forming, as it were, permanent historical facts for time to come. Architecture, art and literature, anthropology, geology, natural history, scenery, and passing events practically cover those subjects which can be carried out and illustrated by photography.

How many of us have negatives stored away in our boxes which we may not place much value on, but a print from such might assist and form a nucleus, a collection that might go to help and form an interesting exhibition in some of the schools; again, a slide made from such a negative might go towards forming a lecture such as would prove useful for the teaching of one of the many subjects previously enumerated.

The question of cost is a matter that the educational committees will meet most probably, and will be arranged as soon as the scientific bodies of the country come into touch with them, for undoubtedly sub-committees will be formed, and it is these who will have the arrangements in their hands later on.

The educational value of photography is surely and gradually being appreciated. It is true much has been done already, but much has yet to be done. The strengthening of our science now means that seeds of interest, once sown, will be bound to bring fruit in due season. We, as an important body of photographers, should never by any means check the inquiries of the younger generation, but try by all means in our power to infuse that interest and promote that learning so beneficial for the welfare of our country at large; and lastly, but not least, raise up from the squalor of the surroundings of those whose paths are not all roses to something more than only a superficial knowledge of our science.

FURTHER EXPERIENCE WITH GLYCIN.

By William Brooks.

Since my last year's contribution to the "British Journal Photographic Almanac," I have received a great number of letters from all parts of the world on this subject. I myself have continued to use it, scarcely ever using pyrogallic acid. I find there are several pitfalls that are annoying to some, hence the number of letters I have received. When I first used this developer I used ordinary carbonate of potash, costing about one shilling per pound. This was of fairly good quality, and answered my purpose. It was in a very fine powder, and was soon affected by the atmosphere. During the past year or two a fresh sample has come into the market, being somewhat granular and very dry. I found, like many others, if that kind of carbonate of potash was used, that soon after the developer was made up it became almost solid in the bottle. On this point I had numerous letters. At first I thought that something else had been added to make it more eyeable as regards sale. like several other chemicals I could mention, which would be out of place to touch upon here. What I found was that it was a far better sample than I had been using previously, and contained far less water, and when the developer became cold it crystalised out, in the formula I gave was seventeen-and-a-half ounces of water, and by increasing the water to twenty ounces (one pint) matters were at once put right, and the trouble disappeared. I found there was no need to make any other alteration. Another pitfall was, that in some hands the developer refused to work. This I soon found out, the soda sulphite being at fault. There appear to be two kinds of sulphite sold, one costing about 4d. to 6d. per lb., according to where it is purchased, and the best at about 1s. per lb., put up in capsuled bottles. The latter kind I always use. The cheap kind, like the former, I have noticed at several places it has been kept loose in a drawer, and it soon deteriorates and becomes useless. When I make up a developer one cannot be too particular as to the sulphite used, and always cork the bottle again, and replace the capsule. It has always been said that Glycin gives a cold black image. With insufficient exposure it does I admit, but with full exposure it is somewhat warmer, and over-exposure warmer still, especially if the developer has been used several times. To those who make lantern slides on gelatine plates this is a very good developer for the purpose by using an old dilute developer. It gives with some plates a nice rich sepia tone. When this tone is obtained the colour can easily be made into a rich warm purple by intensification with mercury in the ordinary way, followed by dilute liquid ammonia.

STEREOSCOPIC SPECTACLES AND HOW TO MAKE THEM.

By Thomas Bolas, F.C.S., F.I.C.

In our time stereograms, as printed from process blocks, so often appear in magazines and illustrated publications that the restrictions incident to the old-fashioned box stereoscope become an inconvenience, and I know several enthusiastic stereoscopists who discard all but the optical part of this instrument, and use the frame containing the lens-prisms just as if it were a reading glass. This system is old in principle. (See drawing of Dubosq's reading glass stereoscope, on p. 69 of "Brewster on the Stereoscope," 1856 edition). The reading glass stereoscope is equally convenient for examining the usual slides, or looking over stereograms if mounted in an album; but when the optical part of the stereoscope is used reading-glass fashion, both hands are not free. If, however, the lens-prisms are mounted in a spectacle frame, both hands are free, and the adjustment of the eyes to the optical system remains constant, while the adjustment of the instrument to the stereograms soon becomes as automatic as in the case of ordinary reading matter. Indeed, the stereoscope, mounted as a pair of spectacles, is, to my mind, almost an ideal form for general use.

Those who have specially studied and followed up stereoscopic matters may remember Mr. John Parker's stereoscopic spectacles of the late fifties, or early sixties; but Mr. Parker's spectacles were encumbered with a blind or thin plate on the bridge, to prevent the right eye seeing the left picture, and *vice versâ;* an addition which appears to me quite unnecessary, or superfluous, although, in the absence of such a screen, the combination image is certainly flanked at each side with a faint and unobtrusive single image.

The mounting of the ordinary lens-prisms in a spectacle frame is a very easy matter; but, in the absence of commercial stereoscopic spectacles (and I have not seen any since the time of Mr. Parker), the amateur may conveniently make his own stereoscopic spectacles by cementing prisms or prism-lenses to ordinary spectacles by means of Canada balsam. The best arrangement of this kind that I know of for general purposes is a pair of plano-convex spectacles, to the flat sides of which are cemented the flat sides of circular lens-prisms, about ¾ in. diameter, taken from the old-fashioned form of stereoscope, as depicted on the cover of "Brewster on the Stereoscope," 1856 edition. The spectacles may generally be of about 20 in. focal length, the additional magnifying power being ordinarily an advantage when the box of the stereoscope is eliminated; but any magnifying power may be selected, or plain flats can be used if no additional magnifying power is wanted. On the glasses being cleaned and warmed, a drop of Canada balsam is placed in position on each lens, and the prisms are steadily laid in place. At this stage the spectacles can be tried, and any required adjustment as regards position can be made; after which the spectacles are laid aside horizontally for the balsam to harden at the edges.

Variations to suit individual requirements will suggest themselves, and the principle of the so-called bi-focal spectacles can be introduced by cementing the prisms on the lower halves of the spectacle lenses. In this case, one looks through the prisms when viewing slides, and over the prisms at other times.

CLEANING GELATINE FILM FROM OLD NEGATIVES.

By Rev. F. C. Lambert.

There are so many uses for pieces of clean glass that the photographer is frequently called upon to clear away the gelatine film from an old negative. On this point we may offer two wrinkles. First: If, on development and fixing, I find the negative unsatisfactory—a waster, in brief—my plan is to dip it in water for a second and then lay it aside just as it comes from the hypo fixing bath, with the film saturated with hypo. After a few days' exposure to the air the film may be removed by seizing one corner of the film and gently pulling it off in one piece. Secondly: Negatives that have been washed and dried require other treatment. These are collected until a bout of platinotype printing is undertaken. Then, after the acid fixing (or clearing) bath is spent, the plates are placed in it for, say, ¼ hour, when it will be found a comparatively easy matter to remove the film by first frilling it along its edges and then gently pulling from corner to corner. A third method for obstinate cases may be mentioned. First soak the film in a solution of kitchen soda and water, *e.g.*, a handful of soda to a quart of water, then, without washing, transfer the plate to dilute hydrochloric acid, say one part acid and 20 or 30 parts water. Then with a stiff nail brush scrub away the film.

WHY?

By Arthur Payne

A Straight Talk to all Society Members.

Why do you think that when you have paid the club subscription you have discharged your liabilities to your fellow members? Remember that the word "Society" thus applied means mutual assistance.

Why do you appoint officers at the annual meeting and then adversely criticise the way in which they run the Society? Do you not think they do their best? And if others can do better, then why not appoint them?

Why do you sit silent at the meeting, and afterwards complain of the business transacted? Would it not be fairer to voice your opinions in the meeting? If you are unable to speak write a note and pass it to the chairman.

Why do you not accept the wishes of the majority?

Why ask gentlemen to judge your exhibition if you have no faith in their opinion? The judges of an exhibition only profess to select what in their opinion is the best work amongst that which is competing. To appoint judges and then to quarrel with their awards is (though many fail to see it) deprecating your own judgment.

Why do you invite lecturers to give you the benefit of their knowledge, and then so far forget your duties as host as to absent yourself from the meeting? If you do not want to hear him, why invite him?

Why do you insist upon the organisation of club outings, and then fail to attend, when probably an outing has been arranged for your benefit, and possibly on your suggestion?

Why do you belong to a photographic society? The success or failure of your society depends upon the answer.

RADIUM.

BY A. L. HENDERSON.

WELL, what do you think? Will it be useful in photography? I venture to predict that there will be a great future for it. The scarcity and enormous price will delay experimenting. I have had the privilege of having on loan from a scientist about 1-3,000 of a milligramme for experimental purposes for twenty-four-hours. My first, and I may say the only, experiment I made was to use it as a sensitometer. I took a specially slow lantern plate, and placed the tube containing the radium (without a florescent screen) as close to the sensitive surface as I could, carefully timing the exposures. Each exposure exceeded the previous one by four seconds, *i.e.*, 4-8, 12-16, and so on. The plate developed rapidly, and the shortest exposure was overdone. The scale of densities seemed very good. Some of your readers may wonder what might be my object in this. It is pretty well known that two emulsions can be made that will register the same speed when tested by, say, Warnerke's sensitometer, yet in the camera one may be much more sensitive than the other, and both being pure silver bromide. Will it ever be possible to get a sensitometer that will obviate this? I think radium may help us. Are the heat rays, the X rays, or some other rays responsible for these peculiarities? Any of these rays illuminated may give a different result on a plate. Unfortunately, my laboratory is so disorganised that I am unable to continue experimenting in emulsion work; but there are many workers who can take up this branch. One cannot imagine any science that will not be benefited by this wonderful metal. As a substitute for gas in aeronautics, a hot air balloon may be kept in mid-air and propelled indefinitely at no cost for power beyond the original value of the radium.

PINKING OF GELATINO CHLORIDE PRINTING-OUT PAPERS.

BY ONS.

A CAREFUL investigation of the cause of pinking is being undertaken; but I am of the opinion that a few preliminary notes on the subject may be of use to those who are troubled with this aggravating but, unfortunately, prevalent, defect in gelatino chloride paper. By pinking is understood the presence of a pink tone in the more delicate half-tones and high lights, although the remainder of the image has toned to the normal colour. This defect may be so great that the whole of the high lights of the picture are tinted; but it does not often occur to such an excessive degree. Vignetted pictures often show signs of pinking in the lighter portion of the vignette. Pinking may be caused by the constitution of the gelatino chloride emulsion; but this is outside the province of those that use the paper, and can only be rectified by the manufacturer; but there are also many other causes due to defective manipulation, the most common of which being the high temperature of the toning bath. Before proceeding, I should say that the following remarks apply in general to all gold toning baths, but in particular to the ammonium sulpho-cyanide bath, this being the most widely-used toning bath for gelatino chloride prints. The temperature of the toning bath must never rise above 15 C. (60 degrees F.), and must be kept as cool as possible with ice if necessary, a temperature as high as 70 degrees F. giving very decided pinking.

Another cause is length of washing between toning and fixing. The prints must be rapidly rinsed in two changes of water if they are not to be fixed at once—standing, without thorough rinsing, being an important cause of pinking; or, if it can be done without contaminating the toning bath, it is more satisfactory to transfer the prints directly into the fixing solution from the toning bath. Minor causes of pinking are: excessive strength of the toning bath in ammonium sulpho-cyanide, which should not be increased beyond 10 grs. per oz.; addition of fresh gold chloride solution to weakened bath while in use, and an alkaline condition of the sulpho-cyanide toning bath; this should be very slightly acid, or perfectly neutral. For uniformity in toning I recommend the systematic method, viz., using a given number of prints to a grain of gold chloride; thus, to tone ten 5 by 4 prints to a purple, a bath containing 1 grain chloride of gold, 10 grs. ammonium sulpho-cyanide, and 12 oz. water, prints to be toned for 8 minutes if temperature of bath is about 60 degrees F.; if colder, for slightly longer, say, 10 minutes. Fixing and washing as usual.

RESITTINGS.

By J. H. Smith.

What shall be done in the way of resittings is often a vexed question among photographers. Submitting rough proofs from unretouched negatives is very often the cause of dissatisfaction among the fairer sex especially, and in nine cases out of ten the negatives, if retouched, and a finished proof submitted, will not fail to please. You cannot seem to make the average sitter understand that the finished photograph will look quite different when finished. The objection to rough proofs is invariably. I look so old, or my eyes look funny, or I have not got such a large waist. Sometimes you fail to convince a sitter that all this will be altered in the finished photograph, and they insist on having another negative taken, and often object to pay the extra charge. In many cases the dress, bodice, or hair is at fault although they will not admit this is so. Photographers should notice when a resitting is given if the dress has been changed, and if so a charge should be made. I make it a rule if the negative is a good one and the sitter makes no objection, to submit a finished proof, and in most cases with success. If the dress or anything else is at fault no amount of persuasion will have any effect, in nine cases out of ten the finished proof gives perfect satisfaction. If your sitter should then decide to be taken again you will have no difficulty in getting him or her as the case may be to pay for the extra sitting. I find it a good plan when taking lady sitters to have a young lady assistant in the studio to attend to little matters of dress, etc., moreover, a lady feels more at home with one of her own sex. I do not mean to say this is necessary in all cases, but when a lady is inclined to be at all nervous she will certainly feel more at home. Don't pull your sitter about more than you can help in posing, if you want a natural photograph. Many ladies complain that Mr. So-and-So fussed about me till I was quite nervous, and I did not like the photograph a bit. In photographing children sometimes, on coming into the studio, they will begin to cry, and all the toys and coaxing in the world will not effect a cure. This is on account of coming into a strange place and seeing strange faces. When this happens, if you have time to spare, play with the child. Then let the mother take the child away, bringing it again in an hour's time, when no doubt you will obtain a good photograph, at least, I have found this to be the case with many children. The most difficult to manage is the shy child, and those who, having been spoilt by their parents, won't allow you to do anything with them. You can dispense with the mother here. Let her leave the studio on the pretence of buying sweets, etc., when with a little patience you will no doubt get a successful negative. The photographer that would be successful in taking children's portraits must first stoop to the level of a child; must be patient, not irritable, and naturally fond of children, and not mind the extra time, expense, and trouble involved

CONCERNING THE DIAGONAL OF A PLATE.

By Procella.

No doubt tables are given in some of the manuals showing the lengths of the diagonals for various sizes of plates, but a simple and easy method of ascertaining the various lengths of these diagonals, and one which is both easily remembered, and which requires the very least amount of calculation, may be of service. A recent writer says: "For the benefit of those who have been so long absent from school that they cannot at the moment remember their fifth form mathematics, let me remind them that the length of the hypothenuse of a right angle triangle is found by taking the square root of the sum of the squares of the two sides"; and he gives an example, which, of course, requires the extraction of the square root to ascertain the length of the diagonal (or hypothenuse) with the figures he gives. The above is, of course, the perfectly accurate method; but such a roundabout way is by no means necessary. It is rather curious that if you take the two sides of a rectangular figure, whose lengths are respectively 3 and 4, the diagonal will be 5. Thus

The square of 3 is 9
" " " 4 is 16
—
" " " 5 is 25

Now, in any plates the sides of which are in the same proportion to each other as 3 is to 4, the diagonal can be ascertained by a simple mental calculation without the extraction of the square root—a calculation which, no doubt, has passed from the memory of many professional men after they have left school, although they may have been familiar with it in their youth. As an illustration of the simplicity of the method above referred to, take, say, a plate whose sides are 9 by 12. If 9 is divided by 3, the result is 3. If 12 is divided by 4, the result is also 3. This shows that a plate 9 by 12 is in the same proportion as 3 is to 4; the sides of the 9 by 12 plate are thus exactly three times larger. All that is necessary, therefore, is to multiply the diagonal of a plate 3 by 4, which is 5 by the above quotient, 3, which gives 15 as the diagonal of a plate 9 by 12. Whenever the proportions are the same as 3 is to 4, the same result will follow with any size of plate. Where the size of the plate is not in the same proportion as 3 is to 4, a slightly different course has to be taken. Take, say, a plate $4\frac{3}{4}$ by $6\frac{1}{2}$. Here the division of $4\frac{3}{4}$ by 3 and of $6\frac{1}{2}$ by 4 gives two different quotients, but it is in such a case only necessary to add the two quotients together, halve the result, multiply by 5, and you get the length of the diagonal, which is 8. When the sizes of British plates were first made, it is to be regretted that fractions were introduced. It would have been much better to have made the quarter-plate 3 by 4, and the others even multiples of these numbers. The above rule is used by practical men, such as builders, in placing a wall at right angles to another. Asking a builder recently how he did this, "Oh," he said, "6, 8, and 10," which, it will be seen, is just the double in each case of 3, 4, and 5. He takes three wooden pins, and places them so that the distances apart are 6 ft., 8 ft., and 10 ft., in the form of a right angled triangle, and he thus obtains the line of one wall at a right angle to the other. This is one of two propositions in Euclid which are used by practical men, many of whom are not aware of the source from which they are derived.

HOW TO PHOTOGRAPH A SPIDER'S WEB.

By F. Martin Duncan.

Who has not paused when walking in a sunny garden to admire the beauty and wonderful construction of a spider's web! It is towards the end of the summer and during the autumn that the spiders of our gardens construct the largest and most elaborate webs, and then is the best time to start photographic operations. Although at first sight it seems a simple subject, the web of a spider will be found to present many difficulties to the photographer. The two most important are vibration and effective lighting. The vibration of the web may be caused by the wind, or by the spider herself, the latter being the most troublesome, as it is not so easily detected. If the spider is at the centre of her web, which is the best position for the photographer, she will not vibrate the web unless observed or a victim blunders into it. Should she, however, be hiding under a leaf to which one of the chief supporting threads of her web is attached, then it will be very difficult to obtain a critically sharp negative of the web, unless a very short exposure of, say, 1-70th of a second be given. The reason of this is that her ladyship, although apparently resting under the leaf, is really on the watch for prey, and she holds two extremely fine threads, which are fastened at one end to the centre of the web. These fine threads she from time to time gently twitches, so as to cause slight vibrations to pass over the web, vibrations difficult to see with the eye, but faithfully revealed by the camera. When in the middle of her web she generally remains very still, knowing full well that undue movement will frighten her victims and attract her foes.

Now, as to the lighting. Generally speaking, the web is constructed in such a position that the whole of it is not visible at once, giving an appearance of only half a web existing; on changing the position of view the visible half becomes invisible, and that portion which seemed wanting is revealed. This is the secret of the reason why flies blunder right into the web; in dodging the visible danger they rush into the invisible. Now, with a little care and trouble, the photographer may quite get over the difficulty. All that is required to render the whole of the web visible, and to make it stand out boldly in relief, as if wrought of finest silver threads, is to hold behind it, and tilted back at an angle of about 45deg., a good black velvet focussing cloth. The effect is delightful, is simple, and will ensure a good and striking photograph being obtained.

The beautiful frost forms on a window may be obtained in the same way, the velvet being held at about the same angle outside the window and the photographer working from within.

DISCURSIVE REMARKS ON EVERY-DAY HAPPENINGS.

By Edward Dunmore.

Perhaps the title I have chosen is more fit for a twenty-page article than for a short one, suitable for this publication. However, as it is written let it go. It is some years since I gave up the active pursuit of photography, but still have the opportunity of seeing and examining a good deal of amateur negative-making. The deductions drawn therefrom are not favourable as to the production of really pictorial work. Hand cameras are decidedly the most favoured instruments at the present time, but quite unsuitable for pictorial constructiveness. The image is certainly visible on the finder, which is useful so far as indicating what view may be expected on the plate, but valueless in the composition of a picture. In order to see the view on the finder the camera must be held low, much lower than the ordinary height of observation; it is in some instances possibly an advantage, but one is practically limited to this low point of sight which by the nature of the thing allows no latitude whatever unless it is lowering it still more. We all know that raising the camera, even above the level of ordinary eyesight is frequently of the greatest importance in securing an artistic result. Unfortunately many things now seem to be sacrificed for the questionable advantage of saving trouble, and that seems the principal reason why hand-cameras are so popular. Not that I dispute that excellent results are sometimes secured, but where there is one good negative there are a hundred bad ones (to the advantage of the plate-makers), the good ones being usually flukes. In making an exposure the eye is fixed on the finder more for the purpose of detecting movement of the instrument than watching the picture. The advantage of a stand camera in this respect is undeniable, as in one case the image has to be followed and watched in a tiny reflector, and in the other the camera is stationary; the subject alone is observed direct. This difference in effecting an exposure has great influence on the result obtained. Much uncertainty exists as to the proper density of a negative, even amongst amateurs who are fairly proficient. Most negatives are intended for printing on the ordinary P.O.P., and as a rule are seldom strong enough, or they go to the other extreme and are made too dense. The time of exposure with a snap-shot is usually pre-determined for some time at least before exposing, the quality of the light in a great number of cases being totally ignored at the exact time the exposure is made. We know in ordinary time-exposures the importance of judging the time correctly, and that the light varies with passing clouds. With very rapid exposures a proper estimate is still more important, and errors in this direction are possibly responsible for the great irregularity of the work. Another topic—printing. There must be thousands of good negatives taken on wet collodion that are unsuitable for printing on the modern gelatine papers, and for which a use might be found if a surface was prepared equivalent to that of albumen paper. Many negatives might be utilized in the preparation of post cards (the present craze, which as yet shows no signs of abatement), as well as for printing in the ordinary way.

STABILITY OF THE LATENT IMAGE.

By J. Barker.

About eight years since some gelatino bromide plates were prepared, all being from the same emulsion, with the following additions:

No. 1. Plain bromide well washed.
No. 2. Ditto with the addition of 1 grain of potass. bromide to each ounce of No. 1 emulsion.
No. 3. Ditto, with the addition of 1 grain of potass. iodide.
No. 4. Ditto, with the addition of 1 grain of ammonium chloride.
No. 5. Ditto, with the addition of 2 grains of tannin.

These were all exposed under, as near as possible, exactly the same conditions, and packed away with a variety of substances between the plates and in contact with the film, some of which were dark orange red paper, light yellow chrome paper, and grey Swedish filter paper, each being ordinary commercial samples.

The results from some of these plates, which were recently developed, were briefly as follow:—No. 1: The samples packed with both Swedish filter and orange red paper developed perfect. The sample packed with light yellow paper developed badly, being foggy and patchy. The packing showing practically the same results in each of the other cases need not be again referred to.

No. 2: Developed clean but as though considerably under-exposed.

No. 3: Developed very clean, but only traces of brilliantly lighted portions could be discerned, the latent image having been practically destroyed.

No. 4: Was slightly patchy, as if the gelatine had become disintegrated; the shadows, however, developed clean, the image altogether being rather dense, as if under-exposed.

No. 5: Showed a faint trace of the image before development, but was slightly under-exposed, although a fairly good negative was obtained.

The general results to be deduced being:—

Iodides practically destroy the latent image. Bromides obliterate detail in all but the strongly lighted parts.

Chlorides disintegrate gelatine and obliterate the finer details of the latent image.

Tannin preserves the detail but slightly impairs the sensitiveness, requiring longer exposure to compensate.

ENEMIES OF PHOTOGRAPHY.

By C. T. Sutton.

Carelessness and dirt, either of a chemical nature, or what is ordinarily classified as dirt, or, to use a well-known phrase, "matter out of place," are two of the greatest, if not actually *the* greatest, enemies of photography, and a very large percentage of spoilt negatives, prints, and chemicals are traceable to one or the other, or both of these. Unfortunately, these evils are not confined to amateurs alone, for many professionals, who would almost be expected to know better, are great sinners in this respect. It is almost impossible to take up a photographic periodical without finding a query from either an amateur or professional about some trouble, to which the answer is that it is either caused by carelessness, dirty hands, or some dirty utensil.

Toning and fixing are often carried out in the same dish; certainly the dish is washed out first, forgetful of the fact that there may be cracks in the glaze, and the chemicals, being in an extremely fine state of division, may lodge in these cracks, thereby making their removal difficult. Hypo is often splashed about indiscriminately in the room where plates, papers, and chemicals are kept and used. Salts and solutions of gold, silver, and platinum are kept in the light instead of in the dark, heedless of discolouration and reduction, which, owing to their unstable nature, they are very liable to. Plates, papers, and chemicals are stored on high shelves, in rooms where gas is freely burnt, with the result that they are deteriorated, if not spoiled, and the makers are often blamed where the user is solely at fault. Heat alone has a certain effect upon some plates. It should be remembered that photography involves some of the most delicate and intricate chemical reactions, many of which are not thoroughly understood even by the best chemists of the present day.

Dust, more especially if it be of a metallic nature, will cause little black specks in printing-out paper, through the reduction of the silver. No matter how clean the operator's hands may be, they will mark printing-out paper if the film is handled; and what the result is when the hands are chemically dirty may be easily imagined. Red lines and marks upon prints after toning are generally traceable to careless handling of the paper in the previous operations.

Mistakes sometimes occur through chemicals and their solutions being kept in bottles without labels; and where the chemicals are very similar in appearance, it is difficult to tell which is which. A little time spent on labelling the bottles will often save a good deal of trouble and expense.

LIGHTING GAS MANTLES.

By T. C. Hepworth, F.C.S.

In places where the photographer is out of reach of the electric current he is only too glad to enlist the incandescent gas mantle in his services, for it not only affords a very white light but it is economical in comparison with the old bats' wing burners. But the mantle is somewhat troublesome to light; it is true that a byepass burner can be used, as they are used on all the street lamps, but the small flame when burnt in a room has a trick of making a most unpleasant smell. Some burners seem to be free from odour, but others are so disagreeable that sometimes their use has to be discontinued. I have lately seen an automatic gas lighter, which I think obviates the difficulty referred and dispenses with the byepass, and as it is cheap it should command wide employment, unless that is, it should develop some vice which is at present undetected. This lighter is the same in principle as the Dobereiner hydrogen lamp, which was first brought forward in the early years of the last century. The tinder box, with its flint and steel, was still in use, for, although phosphorus had been known for a couple of centuries, its price, about 60s. an ounce, prohibited its use as a fire producer. No one could foresee that in a few years a method would be found of extracting it cheaply from bones, so that the minds of inventors were turned towards different ways of "striking a light," and the hydrogen lamp was the outcome of many experiments. In this lamp a little stream of the gas was caused to impinge upon a nodule of spongy platinum, the metal was thus rendered white hot and the gas was fired. Some few years back a gas burner was patented with a platinum attachment which lighted the gas as soon as it was turned on, but it did not come into common use, owing, I believe, to the difficulty of adjusting it to the ordinary fish tail or bats' wing burner, so that the flattened stream of gas would exactly hit it. Since then various gas lighters at the end of rods have been brought out, generally consisting of a little tangle of fine platinum wire enclosed in a protecting cage. One I have which is designed for the pocket. They all worked well enough when the position of the gas bracket or gasolier could be seen, but it was obviously a ridiculous proceeding to light a match in order to discover the place at which to apply the contrivance. I have lately been shown a fresh device on the same principle, which obviates these difficulties, and which is adapted for use with the incandescent gas mantle, and thus dispenses with the use of the byepass. The little cage of platinum is attached by means of a clip to the top ring of the glass or mica chimney, and when the gas is turned on the metal immediately glows, and the burner is lighted. It is true that the lighting takes place with that explosive suddenness which it does when the gas is lighted with a match from the top, and the shock is calculated to reduce the life of the mantle in a manner which does not happen with the byepass. But mantles are now so very cheap that this slight disadvantage may be almost ignored. The new lighting device is certainly worthy the attention of photographers and of the public generally, if only because it renders one quite independent of matches.

TABLES OF CONSECUTIVE DEPTHS OF FIELD.

By. J. W. Salisbury.

Take any three consecutive distances in the tables, the first representing the furthest point in focus, then the second will represent the point focussed on, and the third the nearest point in focus. The tables are calculated for stops f/11.3 and f/16, but if it be required for stops f/5.6, f/22.6, f/44.2, we multiply the distances under f/11.3 by 2, 1-2, 1-4 respectively, and if for stops f/4, f/8, f/32, f/64, we multiply the distances under f/16 by 4, 2, 1-2, 1-4 respectively; the result will, however, be closer to the truth if we first subtract the focal length of the lens used from the distances given in the table, and after performing the above-mentioned operation add the focal length of the lens used to the result.

Focus 18 inches.				Focus 14 inches.				Focus 10 inches.				Focus 8 inches.			
f/11. 3		*f*/16		*f*/11. 3		*f*/16		*f*/11. 3		*f*/16		*f*/11. 3		*f*/16	
ft.	ins.	ft.	ins.	ft	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.
Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.	
240	2	170	3	145	6	103	3	74	6	52	11	47	10	34	0
120	10	85	10	73	4	52	2	37	8	26	10	21	3	17	4
81	1	57	9	49	3	35	2	25	5	18	2	16	5	11	9
61	2	43	8	37	3	26	8	19	3	13	10	12	5	9	0
49	3	35	3	39	0	21	7	15	7	11	8	10	1	7	4
41	3	29	7	25	3	18	2	13	1	9	6	8	6	6	3
35	7	25	7	21	9	15	9	11	4	8	3	7	5	5	5
31	4	22	7	19	3	13	11	10	1	7	4	6	7	4	10
28	0	20	3	17	2	12	6	9	0	6	7	5	11	4	3
25	4	18	4	15	7	11	5	8	2	6	1	5	5	4	0
23	2	16	10	14	3	10	5	7	6	5	7	4	11	3	8
21	5	15	7	13	2	9	8	7	0	5	2	4	7	3	5

Focus 7 inches.				Focus 6 inches.				Focus 5½ inches.				Focus 5 inches.			
f/11. 3		*f*/16		*f*/11. 3		*f*/16		*f*/11. 3		*f*/16		*f*/11. 3		*f*/16	
ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.
Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.		Infinity.	
36	8	26	1	27	0	19	3	22	9	16	8	18	10	13	5
18	8	13	4	13	9	9	10	11	7	8	4	9	8	6	11
12	7	9	1	9	4	6	9	7	11	5	9	6	7	4	9
9	7	7	0	7	2	5	2	6	0	4	5	5	0	3	8
7	10	5	8	5	10	4	3	4	11	3	7	4	1	3	0
6	7	4	10	4	11	3	7	4	2	3	1	3	6	2	7

CLOUDS IN PHOTOGRAPHS.

BY P. J. SLATER.

YEARS ago, in the early days of photography, it was the ambition of nearly everyone to produce landscapes in which the sky portion was represented by clear, white paper, and it was not until someone dubbed them "bald-headed landscapes" that photographers generally saw the mistake they had been making. Now this is all changed, and no one would hardly dream of sending any landscape picture to an exhibition with the sky represented by a perfectly white patch. Indeed, in many of the photographs exhibited, the sky appears to be the dominating feature, the landscape itself consisting of a few simple and unimportant details.

Unfortunately, however, many pictures are produced year after year with skies printed in, which are totally unsuitable for the landscape. A landscape taken at, say, mid-day, in which clouds have been printed from a negative taken in the evening, appears, to the careful observer, almost ludicrous.

Special care should always be taken to fit a suitable sky to the landscape. Never print clouds lighted from the right into a landscape lighted from the left, or *vice versâ*. It is a good plan, when making either the cloud or landscape negative, to note down time of day, position of the sun, and other details, in a pocket-book kept for the purpose, for future reference.

Although it often occurs that landscape and clouds are both obtainable on a single plate, it is generally advisable to make separate exposures for each subject. For the production of cloud negatives, backed orthochromatic plates should be employed. When photographing some cloud forms, such as light cirrus, or cumulus, clouds on a blue sky, a light filter is a *sine quâ non*. An open stretch of country, with a clear, unbroken view, should be selected. It is a good plan to make the negative rather larger than the finished print is intended to be, so that any portion of the sky may be used for printing into the landscape. Do not tilt the camera too much, but allow the landscape to occupy from ½ in. to 1 in. of the bottom edge of the plate.

The exposure must be short, and will be, roughly speaking, about one-fifth or one-sixth that required for an open landscape. Development should not be carried too far; the aim should be to produce a fairly thin and delicate negative.

The use of a fairly dilute developer, and one not too strong in pyro, will help to produce a suitable negative.

HINTS TO BEGINNERS IN ARCHITECTURAL PHOTOGRAPHY.

By W. P. Wiseman.

The following hints are the outcome of a considerable amount of work among our parish churches, and, while doubtless containing nothing new to the advanced worker, may prove useful to the inexperienced in this most interesting branch of our art.

For architectural work the best type of camera is the square bellows pattern, and it should be provided with a fairly long extension to enable a long focus lens to be used. It should have a front permitting a good amount of rise and fall, and, of course, a double swingback. Given a lens with good covering power, it is, as a rule, better to use the rising front rather than to tilt the camera and correct with the swingback. A levelling top to the tripod of the ball and socket variety, or something similar, is invaluable as a ready means of levelling the camera. In interior work the tripod legs have often to be placed so awkwardly as to render it well-nigh impossible to level the camera by their means only. A spirit level should always be carried, and the camera levelled horizontally, as well as vertically. A good actinometer will obviate much uncertainty in exposure, and be the means of a great saving in plates.

Isochromatic plates are to be preferred, and should be backed. This is an absolute necessity for interior work, and it is well to make it a rule to use backed plates for outside work as well, for pinnacles and suchlike are often greatly marred by halation.

A focussing scale on the baseboard used in conjunction with a tape measure will prove most useful in photographing details in dark corners. In this connection it is well to make out a table showing the size of objects with any given lens which can be secured at certain definite distances. It is then only necessary to measure your object, set up the camera at a suitable distance with the lens pointing at its centre, focus by the scale, and expose. The picture can be centred either by the aid of a small finder of the brilliant order with the help of a lighted match held by a friend, or even a piece of white paper damped will adhere to an object a sufficient length of time to enable a sight to be taken. A small bit of wax candle will often come in useful for this sort of thing. In lighter situations a piece of card with bold and black printing upon it is a splendid thing to focus upon.

Roofs can readily be photographed by focussing some object situated at about the same distance from the camera, which can then be placed upon the ground or elsewhere, with the lens pointing towards the centre of the section of roof required. The shutter of the dark slide having been drawn, the camera should be carefully levelled in both directions horizontally. A couple of small wooden wedges come in handy here, and a small circular spirit level is a very convenient form to use.

Generally speaking, it will be found that parts and details of buildings make more satisfactory pictures than general views. It is very difficult to get a good general interior view in bright sunshine, particularly if there be much clear glass; bright diffused light is much the best for all inside work.

Ruskin calls a landscape photograph "an amusing toy," but one of early architecture "a precious historical document." He also urges that old buildings should be photographed "stone by stone, and sculpture by sculpture."

We may not be able to concede quite so much, but there is no doubt that a well-executed series of architectural photographs is an interesting and valuable possession, and well repays the labour spent in its acquisition.

ACETONE SULPHITE; ITS PRACTICAL UTILITY.

By T. Thorne Baker, F.C.S.

It is perhaps difficult to write on a subject about which one feels very enthusiastically without the danger of influence and prejudice directing the steps of the author; but in such a case as the present, where I wish to point out the advantages that can be derived by making use of one certain chemical re-agent, it is perhaps permissible to bestow such praise upon it as the result of many months' practice with it warrants. There is a certain charm about using acetone sulphite, as it is a floury, white powder which dissolves very readily in water; and where it is used as a preservative there is not, except in certain cases, the necessity of accurately weighing it out.

It can be made to serve the purposes of preservative for developers and fixing baths, of restrainer for developers, and reducing agent in other cases. I propose to give a practical note or two on these several applications, one by one.

When used as a preservative for developers I have found it convenient to use about twice the quantity of organic reducer taken; thus a solution of hydroquinone one part, acetone sulphite two parts, water one hundred parts would keep almost indefinitely. It replaces quite five times its weight of sodium sulphite, and owing to its compactness and solubility it forms a ready means of preparing concentrated developers.

For touring purposes I suggest powder developers somewhat as follows:—

Developer (such as hydroquinone, edinol, &c.	1 gram or 15 grains
Acetone sulphite	2 grams or 30 grains
Sodium carbonate (desiccated)	5 grams or 75 grains

Each powder of the above proportions may be corked up in a test-tube or small glass cylinder, and then dissolved in 100cc. or 4 ounces of water when required for use. A distinct advantage rests in the fact that the acetone sulphite, being of a slightly acid nature, acts sufficiently as a restrainer to obviate the necessity of potassium bromide.

The restraining action of acetone sulphite is made use of for obtaining warm tones on gas-light papers, which it renders very certain and easy. The following will be found a good formula to employ as a basis for working. The tone, of course, depends on the amount of over exposure given and the amount of alkali used:—

Edinol	1 part
Acetone sulphite	5 parts
Sodium carbonate (cryst.)	4-8 parts
Water	100-150 parts

For developing partly printed P.O.P. without previous immersion in bromide solution I have found the following to give as good results as any I have obtained by other means:—

Edinol	1 part
Acetone sulphite	2 parts
Water	250 parts

(Or more, according to the particular brand of paper).

To this add equal parts of ammonia and ammonium carbonate, in quantity varying as the tone required. If instead of plain fixing the prints are then placed in a combined toning and fixing bath, they come out much as ordinarily printed pictures, except for the inevitable lack of pureness in the whites.

Perhaps the best use to which acetone sulphite can be put is its introduction into the fixing bath; which it renders acid and at the same time preserves indefinitely. I have open dishes of twenty per cent. hypo-solution containing, roughly, half an ounce of acetone sulphite to the pint, lying about in my laboratory for sometimes a fortnight, and it rarely gets discoloured, even when plates developed with different kinds of developers have been fixed in it without any intermediate washing.

Some recent experiments shewed that a five per cent. solution of acetone sulphite is a useful "blackening" bath for plates bleached with the mercuric chloride intensifier. According to Prof. Precht, much better gradation is obtained in the intensified negative than if sodium sulphite be used. The "re-blackened" plate is, however, of a greenish-brown colour which makes an originally black negative seem almost like a pyro-developed one.

The above notes will, I hope, indicate some of the directions in which acetone sulphite may be employed; it is, to say the least, a very handy chemical to have in the dark-room, and one which improves on acquaintance.

PHOTOGRAPHY FOR THE PRESS.

By A. Whiting.

Many photographers who have sent excellent photographs for reproduction in some publication or other, have been disappointed at the printed result, which has probably been flat and blurred, especially if it has been printed upon common paper. The point to bear in mind is that the half-tone process (as its name implies) has no pure whites or blacks, and therefore the reproduction will be less contrasty than the original. So that, if we intensify the contrasts in the picture to be reproduced, we shall succeed in getting a better rendering of the subject. Work up your print (it matters little whether it is glossy or matt, P.O.P., bromide, or other process) with pure white in the high lights, and with "Process Black" (Winsor and Newton) in the deepest shadows. At the same time intensify (with brush work) the contrast in the half-tones and detail likely to be lost. If the picture is to be reproduced on common paper, use a rather warm-toned P.O.P. print to work upon, but if for a better-class magazine, which will be printed on good semi-glossy paper, then contrasts are rendered much better, and a good bromide or platinotype print may answer equally as well.

If you wish to have the picture reproduced by the "line" process, which is the one generally used by newspapers and other periodicals in which common paper is used, the method is to draw the outline of the picture upon the surface of the photograph (P.O.P.), using a steel pen and *fixed* Indian ink. After the picture is thus sketched the photograph must be bleached with mercury or with the following, viz.:—

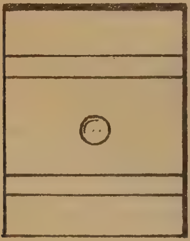
Iodine	5 grains.	
Iodide of potassium	50 grains.	
Cyanide of potassium	100 grains.	
Water	1 ounce.	Mix.

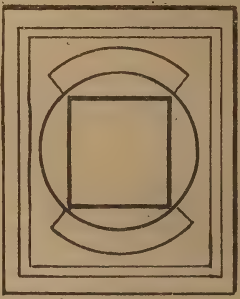
Either of these methods will leave the line drawing whilst removing the photographic image. If the photograph has been printed in the "blue process" (salts of iron) it is often unnecessary to bleach it at all, but it may be done with carbonate of soda if required.

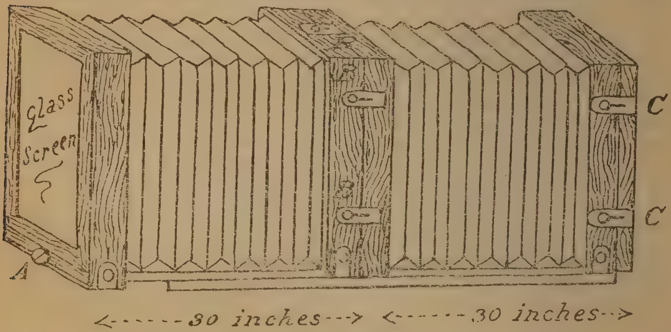
ENLARGING APPARATUS—ADDITIONAL NOTES.

By Lieut.-Col. C. Gardner Vatcher.

Since my last year's article on enlargers, I have somewhat improved on my daylight enlarger. Having found a considerable amount of difficulty in getting a fine adjustment with the apparatus at my disposal, I added a fine focussing adjustment. The cost is so little that I wonder that Messrs. Lancaster and Sons, who turn out the Multum-in-Parvo, do not cater for it. I send with this a rough sketch of the complete apparatus. I found some difficulty in shutting out the light between the negative and lens, so I got the makers to make me a bellows to fix on the lens partition. This will be seen to have a double swing back for the portion holding the negative. I have fixed my revolving frame I spoke about on page 805 in the 1902 Almanac, so that I can straighten up the lines of negatives up to ½ plate. The advantage of this is obvious, as one is able to see what the picture is on the glass focussing







screen. It will be seen that the apparatus is clamped, glass screen end, to a small frame which slides in a groove in the frame which forms the bed for the whole apparatus. Although not originally intending it, the front may be removed by unscrewing the thumbscrews fitting in the brass plates in the lens partition. It then forms a big camera for 15 x 12 plates. The lens partition having a rising and cross front still further gives means to centre the picture. For exposure a small board (clamped to prevent warping) fits over the negative holder. The lens fits on a board that is reversible, so that reductions as well as enlargements can be made.

HOW TO MAKE CHEAP AND USEFUL DEVELOPING TRAYS FOR ENLARGEMENTS.

By J. Leisk.

In these days, when so much has been and is being written on the theory and practice of photography in handbooks and in the photographic journals of the day, it is no easy matter to comply with the Editor's request for a short *practical* article for the "Almanac" without the suspicion of having borrowed the idea from one or other of the publications indicated. Still, there is left the personal ingenuity in constructing or adapting apparatus to suit one's requirements, details of which, though not appearing in any text-books, may yet prove of interest to some of your readers.

When I first essayed to make enlargements on bromide paper, and not wishing to invest in large developing trays until I was sure of success, I set about constructing inexpensive trays for temporary use; but these proved to be so serviceable that I have used them ever since, and have made others of different sizes to suit my wants as they arose. To make those trays, I proceed as follows:—

Having got a joiner to select a piece of plain deal board (yellow pine is best), 5½ft. long and ½in. thick, selected free from knots or blemishes, I had it cut into strips 1½in. wide, and after these strips were dressed smooth I had a groove run along the face of each piece at ¼in. from its edge, each groove being ⅛in. wide and a quarter of an inch deep. Then, to construct a tray 12in. by 18in., I took one of these strips, and with a fine saw cut it up into two lengths of 12in. each for the ends, and two lengths of 19in. for the sides of the tray. These four pieces were then placed together, with the grooved sides inwards, and fastened by two wire nails at each corner.

Before, however, putting in the nails, I procured a few ounces of whitelead in the paste form sold by colourmen (like soft putty), and filled all the grooves with it, and also put some in the joints where the ends and sides join at the corners. I also procured a sheet of common "fifteen-ounce" window-glass, cut to measure 12⅜in. by 18⅜in., for the bottom of the tray. I then took an end and a side piece, and nailed them together at one corner, and did the same with the other two pieces; then, taking up one of these and the sheet of glass, I pressed the latter into the grooves, causing it to force out a portion of the whitelead. I next took up the other end and side piece, and, adjusting the grooves over the exposed angle of the glass, I pressed the whole firmly together until the wood met at the remaining opposite corners, when these also were nailed.

The glass being thus ⅜in. larger than the inside measurement of the tray, and being embedded to that extent in whitelead in the grooves, formed a perfectly watertight joining with the wood.

Finally, after removing the superfluous whitelead which had been forced out of the joints, I brushed the whole woodwork over outside and in with melted paraffin wax, and the tray was complete.

The coating of wax is of considerable importance, and should be renewed from time to time, as it wears off the wood, for, being waterproof and perfectly inert to all the chemicals necessary to development, etc., it prevents these soaking into the wood and causing stains, and it renders it easy to clean the trays with a sponge and water after use.

A tray of the dimensions I have given need not cost more than eighteenpence for materials, and requires very little mechanical skill to make, other sizes costing more or less in proportion; and small-sized trays made as described, but using a lighter wood for the frame, are very convenient for developing small transparency plates, such as lantern or stereoscopic slides, the glass bottom enabling one to watch development and judge density without lifting the plate out of the developer, while a piece of stout thread laid across the tray under the plate, and with the ends over the side, admits of the plate being readily lifted when development is complete.

WAXED PAPER CLOUD AND OTHER NEGATIVES.

By J. Pike.

It is a practice with a few select workers to expose plates now and then upon clouds and other aerial phenomena—sun*rises*, when we can catch them, and sun*sets*, which are more easily obtained. These cloud negatives, if for the purpose of being printed into suitable landscapes, are, after all, of only limited use if retained upon their original glass support. No doubt many a beautiful cloud is wasting its sweetness within the confines of a dusty cardboard box, which might be turned to useful purpose if converted into a waxed paper negative.

The operation is simple enough, the chief being the development of a good and clear transparency from which we print, on sensitised albumen paper, a negative; print well out, tone with one or other of the "gold" baths prescribed, *i.e.*, acetate of soda, tungstate of soda, or borax; the latter bath, *e.g.* :—

Chloride of gold	2 grains.
Borax	40 grains.
Water	10 ounces.

can be used as soon as made, and gives a suitable tone. The print is then fixed, washed, and thoroughly dried before the process of waxing, or rendering it translucent, is taken in hand.

The waxing is accomplished as follows :—Get a shallow tin dish (which should be tested and found to be watertight), and place therein several pieces of hard (and clean) paraffin wax; let the tin be on a tripod within the heat radius of a gas stove, but out of reach of the flame. When the wax is melted, and fairly hot, immerse the prints one at a time. Let them be thoroughly saturated with wax; then remove by one corner, draining completely by resting the opposite corner against the hot tin. The waxed print cools very quickly, and is beautifully transparent, without much tendency to curl. It may be placed between folds of blotting-paper, and smoothed over with a hot iron if required. As the wax is so cheap, it may be best to practise with a few pieces of plain paper of about the same thickness as the print to be operated upon, when it will be quickly seen how the trick is done, and what degree of heat is best for the purpose. The paper negative may be spotted and touched up before waxing.

It is good practice to make a few vignetting papers. Place in the printing frame a piece of clean glass, and on the front of this mount, with gum or seccotine, a piece of cork half an inch or so high; now cut out of cardboard a shape, oval, cushion, or something to suit the subject to be vignetted. Mount this shape by means of a pin neatly on the cork. Put in the frame a piece of the sensitised paper, and print rather deeply in diffused light, and finish as before. Where many copies are wanted, these waxed paper vignettes make the work very much easier.

SOME PRACTICAL NOTES.

By Edmund J. Mills, D.Sc., F.R.S.

Acid Hypo.—This is usually made by adding dilute sulphuric acid to a mixture of hypo and sulphite in aqueous solution. As so prepared, it is often supersaturated with sulphur (or more probably hydric persulphide), which is deposited as a kind of bloom on the negative. Although this deposit can be removed mechanically, it is better to prevent it from making its appearance there. Contact with a rough surface will do this. All that is necessary is to store the newly-made acid hypo in contact with a fluffy tissue—such as clean, old cotton rag—for a few days; the deposit will then form upon the tissue, and so remain.

Blisters on Film.—In my hands, large blisters have sometimes made their appearance in my negatives when beginning to wash after fixing. Although the effects of these may be, to some extent, alleviated by drying the film in a horizontal position, they can be entirely avoided by slightly modifying the makers' instructions. After developing, rinse quickly and float on the surface of acid hypo, film downwards, for half an hour to fix. Drain thoroughly, and, without washing, place in a cold saturated solution of alum for at least half an hour—an hour does no harm. Wash, with weights over the corners of the film, for about one hour. Sponge with a very clean sponge, free from grit, and paste down on slate to dry. Continued experience with slate shows that it is the best support for this purpose. If any paper should adhere to the back of the negative, the best way to remove it is to lay the negative on a round surface—such as a ruler—and file the paper away with a fine, flat file. Retouching is easily done on the rough side.

Use of Mirror.—One is very apt to forget the value of this very useful item in a photographer's equipment. During the recent summer I very much missed it, when desiring to photograph some remarkable gargoyles on a country church. There was nothing for it but to set the camera at an angle of about 45 degrees, and make the best of an awkward position; but some very high specimens, on the edge of a lofty tower, could not be reached in this way, and had to be given up. The mirror would have enabled the camera to remain horizontal, and, of course, all the difficulties would have vanished. Negatives obtained in this way are no doubt reversed; but, perhaps, that is rather an advantage than otherwise. The mirror I use is placed behind the lens. In order to prevent it unscrewing through the weight of the lens, I have fitted three little springs (clock-springs) between the mirror case and flange, so enabling the mirror to keep any angular position to which it may be rotated. The mirror is of optical glass, silvered in front, and has remained untarnished for years. A mirror is a far handier tool to carry than a tilting-board, and has an additional advantage in shortening the pull of the camera.

Slides.—For some time past I have been using a slide invented by my former student, Mr. F. Mackenzie, B.A., of Glasgow (in association with Mr. Wishart). I can speak strongly as to its extreme convenience and great practicability, the outer slide or holder (used for all the plates) being of about the same size as a double-dark slide, and each plate or film being inserted in a case or envelope only just large enough to hold it. Each case is numbered, and, being of ebonite, can be written on with pencil. When inserted in the slide, and the slide placed in the camera, exposure is made in the ordinary way; the door of the slide pushes back the flap of the case, and restores it in due time to its normal position. When the flap is pulled outwards, a slip of velvet moves with it, and cleans the plate from dust as it goes along. The whole arrangement is quite simple and most ingenious. Of course, there is a very considerable saving in bulk, weight, and price. I have consequently found these slides very convenient on tour.

Printing.—"Photographic quality" is a property that many of us desire to get rid of, to the end of obtaining breadth and pictorial effect, especially in many kinds of large work. The various modifications of the "carbon" or chromic process are a great help in this direction, especially for enlargements on rough paper. Here the roughness saves one much retouching. Printing through a sheet of even tissue paper is also of great assistance in this direction. I have used, at times, negatives taken through a process "screen" with very good effect. Similar results are producible by printing through fine linen tissue, or wire gauze; a suitable mesh in these cases is about 120 to the inch. On occasion I have dusted the negative with asphalt in a photogravure dusting-box, fixing the dust with chloroform vapour. Many similar artifices easily suggest themselves. In this manner, sooner or later, one finds one's way to softness and aerial effect, while still retaining sufficient of the (occasionally unpleasant) property called "truth." If only the subjects were always worth the labour!

SODIUM SULPHITE AND ITS USES.

By W. Bailey.

Perhaps the most generally useful chemical employed in photographic solutions may be said to be sodium sulphite, or "sulphite of soda." While taking little direct part in producing the photographic image, it has a wide range of utility in enabling the more active ingredients in a solution to perform their work with satisfactory results. For general use, a solution of 1 part in 20 water (= 5 per cent.) may be adopted as a standard. If desired to be kept for any length of time a "stock solution" of 1 in 4 may be prepared and diluted when required with 4 parts its bulk of additional water. If a developer is required to be made with any of the dozen or so reducing substances in use an addition to our standard 1 in 20 solution of about 6 grains per ounce of pyro, or a corresponding quantity of any of the many substitutes (principally "made in Germany"), which are advocated on account of special adaptability for various uses, will give very nearly the average composition of "Solution A" in innumerable formulæ, while if we dissolve one part of crystallised sodium carbonate (or half the weight of potassium carbonate) in 10 parts of the standard sulphite solution, we shall in like manner obtain "Solution B." It may be noticed that in both A and B the same strength of sulphite solution is employed, and the result of this is that in mixing the two, either in equal parts, as is suitable for ordinary purposes, or in such varying proportions as may be found desirable on account of incorrect exposure or for other reasons, the amount of sulphite per ounce of mixed solution will remain constant; which appears to be the correct principle, as the power of sulphite in preventing stain, etc., is governed by the proportion of that salt to the bulk of the solution, not to the strength of the latter as regards its other components; and for the same reason, if the developer is diluted, this should be done with the sulphite solution in preference to water only. The developer, when equal parts are combined, will contain say 3 grains pyro, 24 grains sodium sulphite, 24 grains sodium carbonate per ounce; and about ½ grain per ounce, or upwards, of potassium bromide will generally be found advisable, which may conveniently be added from a 10 per cent. solution. If a one-solution developer be desired, it may be made at once in a similar way, the quantities of reducer and alkali being half the amount per ounce that would be used for either solution separately. When amidol is the agent used, the addition of 2½ grains per ounce of sulphite solution, with bromide, forms at once an efficient developer, no alkali being required. In case of solution A being required to keep for any length of time it is necessary in the case of pyro and some other reducers to add a proportion of some acid or of an acid salt, the most effectual being potassium metabisulphite, of which about 4 grains to the ounce may be used. This should always be employed in solutions of ortol, to prevent stain which is liable to occur if it is omitted.

Our 1 in 20 solution of sodium sulphite will also be found useful in preparing an acid fixing-bath, in which case an amount of citric acid equal to 1 in 80 of the sulphite solution may be added (or an equivalent quantity of other acids, if preferred). The hypo may then be dissolved to the strength required, generally 1 part in 4 or 5 for negatives. Other uses may be found for the sulphite solution, for instance, in intensification or reduction of negatives or bromide prints; being employed, in the former case, to darken the image after bleaching with mercuric chloride, or in the latter, to check the action of a reducer such as ammonium persulphate.

Enough has been said to show the uses of this valuable salt, and the advantage of having a solution at hand, with regard to the preparation of which it may be remarked that the quantity desired of salts, such as sodium sulphite and hyposulphite, etc., may be conveniently obtained by measure, as a few experiments will soon show the space occupied in a measure glass by known weights of the substances, if they are in a fairly granular state, as usually found.

A SIMPLE AND PERFECT METHOD OF BACKING PLATES.

W. H. Walmsley.

It is quite superfluous in these late days to offer any plea in favour of backing plates. In very many instances, some form of non-halation plates are absolutely necessary, whilst in none that I am aware of are they any detriment to the perfection of a negative. Their importance recognised, the best method of eliminating halation from any plate one may be compelled to use is at least interesting. But what is the best method? The answer would seem to be, "One that combines ease and simplicity of application, and removal, with minimum of cost and maximum of perfection in results." Double or triple coated plates certainly possess non-halation qualities of a very high degree, but are costly, a matter of no little consideration to a large percentage of photographers, professional or amateur. Plates, backed with caramel or other light absorbing preparations, are furnished by most makers, but these also cost considerably more than unbacked ones—at least in America. They are certainly non-halation, but the removal of the backing is a dirty, messy operation, quite discouraging to the average amateur; and the same holds good to an even greater extent should he elect to back his own plates in the same manner. What, then, is left to him which will fill the conditions of simplicity and efficacy enumerated above? Let us see.

My work for many years has been very largely devoted to photo-micrography, and almost at its initiation, the value, nay necessity of backed plates, was recognised. All sorts available were tried, including, later, double and triple-coated ones, but the objections, as given, were insuperable. Then it occurred to me that possibly a piece of dead black paper, if moistened and squeegeed to the back of a plate, might answer the purpose sufficiently well, and practical trials proved the correctness of the thought. For a number of years all of my work was done in this manner, without any additional cost for backing. There was one objection to this process; the moisture speedily evaporated from the paper, loosening it from the plate, and, of course, destroying its non-halation quality. This was unimportant in photo-micrographic work, however, as the backing could be applied the moment before making an exposure, thus leaving no time for evaporation to take place; but it utterly prevented the utilisation of the process in out-door work. So the paper backing seemed to possess but a very limited field of usefulness. However, the solution of the problem came from an unexpected and far distant source; so simple, indeed, that I felt like kicking myself for not having worked it out unaided. In a forgotten volume of "The Journal Almanac" a few years past, among several hints contributed by an Indian correspondent was one recommending glycerine-coated black paper as a backing for plates to prevent halation, with some directions for use, which my subsequent practice has not altogether approved. But the germ was there, the discovery was made, and the simple, cheap, cleanly and effective backing for all work, so long desired, was at last a tangible result. I have used it for all purposes, indoor and out, for landscape, architectural, hospital work, and photo-micrography, without a single failure, with no dirt or trouble either in applying the paper or its removal, for some two years, and I bless that unknown contributor to the highly-esteemed "Journal Almanac" for his invaluable hint.

My method of applying and utilising this backing may be briefly given as follows. Other modes can, doubtless, be found equally efficacious, but this one, if carefully followed, is most certainly easy and satisfactory. After long and careful experimenting, the fairly heavy, dead black paper in which Velox and other printing papers are wrapped, was settled upon as being the most suitable for the purpose of any I have seen. This is to be cut into pieces somewhat smaller than the plate (about half an inch each way). These are soaked for a short time in a tray of water, then pressed for a moment between blotting boards, to remove superfluous moisture, and spread flat upon a clean board. A few drops of glycerine are now placed in the centre of each, and evenly spread over the entire surface with the fingers. The first application will require more glycerine than subsequent ones, as the paper will absorb it more readily than afterwards. There must be enough to cover the paper fully, but care should be taken not to use too much. Just enough, and no more, should be the rule, and a few experiments will give the necessary experience. Thus far all the work may be done by daylight, or ordinary gas or lamp-light; the balance must be carried on in the dark-room. The preliminaries here are a table or broad shelf, a clean sheet of blotting or other paper, upon which to lay the plate—face down—a clean, dry towel, some sheets of paraffin paper, same size as plate, and a soft rubber squeegee; to which may be added a slightly moistened sponge. Of course the board, carrying the already glycerine-coated paper, must also be at hand, with the empty plate-holders or dark slides, close by. Any form of these may be used, but presuming that we have the common "book form," the directions will be specially for them.

Taking a plate from its box, we lay a sheet of the black paper upon its back, the glycerine-coated surface in contact with the glass, and gently smoothe it out with the sponge. Then, lying it face down upon the blotter, spread the towel over it, and with the rubber squeegee rub, gently but firmly, until perfect optical contact is assured. After placing in the holder, cover the back of plate with a sheet of paraffin paper and insert the septum. The second plate is treated in same manner, and we have the dark slide loaded ready for use at once, or a month later, it matters not which. I have not tested the extreme length of time during which plates thus treated are free from halation, but after expiration of a month in hot weather have found them fully equal to freshly prepared ones. After exposure and before development the backing papers are stripped off and laid one upon another in an empty plate-box for further use, which may be repeated many times ere they are worn out. Backs of plates may be wiped off with a moist sponge prior to development, or not, as convenient.

No other form of backing, or preventing halation, can be more efficacious than this simple, easily applied and inexpensive method, and it is most earnestly recommended to all who are interested in the subject. In making some large interior views of a laboratory in one of the University of Pennsylvania buildings, I was confronted with a row of windows on one side, extending to the ceiling: a brilliant sunny day without, and other buildings of the University less than a hundred feet distant fairly glowing in the full rays of the sun. In the negatives all of the fittings of the room in shadow beneath the windows are most clearly detailed, the buildings seen without are perfectly shown, the windows themselves, clearly cut without a trace of halation being visible. And the same result may be seen in views of the interior of several glasshouses in the Botanical Gardens of the University made quite recently.

HOME-MADE POSTCARDS.

By T. N. Armstrong.

To amateurs the following method of preparing and printing their own negatives will be found extremely simple and useful, at the same time the cost of production being a mere trifle.

First, as to the postcards. Any stationer will supply a packet of these cards containing twenty-five in number, with the usual printed heading, but without being stamped, for the modest sum of one penny, and any ordinary photographer possessed of such, in a clean condition, as received from the hands of the stationer, can in a very brief space of time prepare these cards and print pictures upon them that will compare favourably with even high-class photographs.

The first step is to apply a salting solution to the face of the cards. This operation is so extremely simple and so rapidly performed as to be within the scope of a mere child, and is done as follows:—A quantity of clean cold water is placed in a flat dish, and thereto is added common table salt, in quantity about six grains of salt to each ounce of water. A few grains more or less will really make no material difference in the results. When the salt is all dissolved the postcards are taken one by one and wholly immersed in the salting solution for about half a minute, and then each card is taken by one of its corners and dried rapidly in front of a clear fire. Any number of cards can be so salted and stored away for future use.

These cards, when quite dry, are made sensitive to daylight by the application of the following silver solution, which must be prepared with care and filtered into a clean glass bottle. The solution is as follows, and where no great number of cards has to be dealt with only a small quantity of solution need be prepared. A quantity of about four ounces will prove to be a useful supply for any amateur to begin with:—

Nitrate of silver	150 grains.
Water, clean or distilled	4 oz.
Citric acid	3 grains.

With this sensitising solution at hand the postcards are ready for sensitising, and this operation may be done by pouring a small portion or pool of the silver solution on one corner of the postcards, at that part that is to receive the printed image. This small pool of silver solution is then distributed by means of a tuft of clean cotton-wool previously wetted with the silver solution, and when it is seen that the portion of the card is equally wetted or sensitised the card is then held in front of a bright fire and rapidly dried. It is now sensitive to light, and should be shielded from strong daylight.

Negatives to be printed in this manner are best provided with masks, such as are used in ordinary lantern slide mounting, and applied in such a manner as when adjusted in the printing frame permits of only that part of the negative passing light that is to form the picture in the postcard. It will be found, where lantern masks are used, it is necessary to add to their margins by gumming on strips of opaque paper that protects all the surface of the card when in contact with the negative in the printing frame.

Cards prepared in this manner print rapidly in good daylight, and the entire operation of salting, sensitising, and printing may, with fairly clear negative, be all performed within a couple of hours or less.

The solutions above referred to will yield good, vigorous images if the manipulations have been carefully performed and there should be no imperfections in the resulting pictures further than such as are commonly met with in silver printing, and which are amenable to a spotting operation.

When the prints are taken from the printing frames the printing should show a slightly greater degree of depth than is desired in the finished photograph, and at this stage if a warm vandyke brown colour be desired, it is only necessary to wash rapidly for a short time in clean water and fix forthwith in fresh hypo, of the strength of three ounces of a standard solution of hypo to ten of water, leaving the cards in the same for twelve to fifteen minutes, and if the cards will not stand this without the image becoming bleached, either the negatives employed have been unsuitable by lack of vigour or the printing has not been carried far enough. The longer the cards are immersed in the hypo the darker the colour will become. In the hypo they undergo the usual changes of colour, but when dry will present a rich vandyke brown or sepia colour.

Those workers who desire to tone the image to a dark or purple colour may employ the well-known gold and acetate of soda-toning bath, to which the prints will respond readily. If this toning-bath be used it is imperative it should not be used when freshly prepared. Twenty-four hours after being made up is not too long a time to allow of the bath ripening before use, otherwise the prints will bleach. Many amateurs fail in the use of this most excellent toning formulæ from the sole reason of using the bath before it is ripe.

Most beautiful results are obtained by this homely and simple method of silver printing.

A FEW NOTES ON PHOTOGRAPHIC COPYRIGHT.

By E. W. Foxlee.

The present Copyright Act affords photographers ample protection for their works, and it would be very undesirable that the law should be altered, so far as they are concerned. Although the Act gives photographers all they can reasonably desire, yet many neglect to avail themselves of its protection, and, as a consequence, often find their pictures pirated, perhaps by the wealthy illustrated papers or by view of and picture postcard publishers, with the result that the sale of the originals is practically ruined. Had the photographer taken the simple precaution of registering his copyright in the pictures before issuing them, he could have recovered ample compensation for the injury done him by the pirates.

Sometimes a photographer may even profit more by his copyright pictures being pirated than he would have done by the actual sale of them by himself. I am aware of more than one instance where this has been the case. In one a photographer whom I know found a picture he had taken, and registered the copyright in, some years ago, had been pirated in one of the illustrated magazines. He wrote to the publishers calling attention to the fact that the picture was his copyright, giving date of registration, etc., and making a demand for twenty guineas. The next day he received an apology, with an offer of fifteen guineas to settle the matter, and this sum he accepted. Here is another case I may quote from my own personal knowledge. A well-known London firm found that an illustrated magazine had reproduced one of their copyright pictures, but with an altered title—a very common thing with pirates. The firm placed the matter in the hands of their solicitors, with the result that within three or four days the affair was settled by the payment of fifty guineas by way of damages and the solicitor's costs.

When a publisher has pirated a photograph in which there is a legal copyright, he is usually glad to settle the matter on any terms—of course, within reason—that the photographer may name. He knows that he is liable to a penalty—not exceeding £10—for every copy made, for damages, an injunction restraining the sale of any further copies, and forfeiture of all that may be in existence, as well as all negatives and blocks from which they were made. Hence he is, to an extent, at the mercy of the holder of the copyright that he has infringed. With these facts before them, it is surprising that so many photographers fail to register the copyright in every picture they publish, seeing that the registration fee is but one shilling, which outlay the profit on the sale of the first couple or so prints would cover.

In all cases it is well not to part with a single picture until after the registration has been effected, for it should be borne in mind that the law gives no remedy whatever for any piracies that may be committed, or for any copies sold, before the copyright has been registered. Registration after piracy is, however, of some use, inasmuch as it will prevent the sale of copies, though they have been made before the copyright was registered. The sale becomes an offence after the conditions required by the Act have been fulfilled. Then the photographer can obtain an injunction to restrain against anyone selling, or offering for sale, the pictures; he can also sue the sellers for damages. But he will not be entitled to penalties, as he would have been had the copyright been registered in the first instance. Although the holder of the copyright can proceed against anyone who sells, or offers for sale, any copies of the piracy after registration, he cannot proceed against the one who produced them, provided they were made prior to the registration.

Sometimes, when a photographer points out to a publisher that he has reproduced one of his copyright pictures without his consent, he receives by return a cheque for half a guinea, or some small sum. But should he be content with that? Had his permission been asked in the first instance, he might possibly have accepted some such fee. As, however, his property was appropriated without his consent, and perhaps against his wish, and without any intention of payment, the case is different. In these circumstances, why should he not demand a goodly sum from the infringer of his copyright, if only by way of punishment for wrongdoing? As I have said before, when a pirate is "brought to book" for infringing a photographer's copyright, he is usually anxious to settle the matter on very liberal terms rather than let the case go into court, where he will probably be mulct in penalties, damages, an injunction granted, etc., with costs of the action

How many photographers who publish local views, when they see their pictures pirated, have not regretted that they neglected to register their copyright in them, so that they would have had the means of bringing unscrupulous pirates to account, as well as obtaining recompense for the injury done them. The registration of photographs is a very simple affair. At Stationers' Hall forms may be had for a penny each. These are then filled up, as per the plain instructions on them. A print is then attached thereto, and sent, per post or otherwise, with a postal order for one shilling for each picture. The photographer then has his copyright secured to him for the remainder of his life, and to his executors for seven years after his death. This is not a large investment, but it often proves a very remunerative one. Why, then, neglect to register?

A SIMPLE LANTERN ILLUMINANT FOR SMALL SCALE ENLARGEMENT.

By H. Selby.

I imagine that each year sees a reduction in the number of those who depend upon the old-fashioned four-wick oil lamp as an illuminant for enlarging purposes. The objections to it are so many, so manifest, so overpowering. First and foremost, from the point of view of the lady of the house, is its disgusting smell; and first from the point of view of the photographer is the fact that, as a source of light, it is about as far removed from the ideal illuminant as it is possible to conceive. To my mind, not much less objectionable, from the latter point of view, is the incandescent gas mantle. I have not tried how far its drawbacks can be removed by the use of a diaphragm to stop all but a small number of light rays. But this illuminant is in almost every way an advance in point of comfort and ease of working upon the oil lamp. It is easily lighted and put out; it has no smell; and it is very powerful and very actinic. But it is too large—the light should be more concentrated—and the result is a difficulty in obtaining a perfectly evenly lighted disc, even with the aid of a piece of ground glass to diffuse the light.

Now, acetylene gas can be so utilised as to give a flame of most intense power and at the same time of considerably smaller dimensions than the Welsbach mantle; and it is respect of this light that I wish to say a few words in this short contribution to the "Almanac."

To the man who is going to do enlarging on a large scale—both as to size and numbers—it would be, no doubt, worth while to buy one of the generators which are sold at a guinea or so by several makers; but to those who do an enlargement now and then—whose pockets are so shallow as to admit of a moderate-sized enlargement just occasionally, and nothing more—it would not be worth while to indulge in such an expense. I have often thought that one of the ordinary bicycle acetylene lamps, with one or two burners—those lamps that irritate one so much on dark nights by their uncanny brilliancy—would possibly be of some use for the purpose of illuminating a small-sized sheet—say, 12 by 10 or 15 by 12. I am, of course, speaking of the use of a lantern with condenser.

I accordingly made an appointment with a friend hard-by, who is cursed with a four-wick oil lamp, and we made our way to his stable (to which he has been banished, he and his evil-smelling apparatus, by his wife). Now, my bicycle lamp is fitted with one burner only, and the light, in consequence, is not by any means a powerful one, as acetylene lamps go. Still, I was very gratified to find that, using a lens of large aperture, we were able to obtain a well-lighted disc, with perfectly even illumination all over, sufficiently bright to obtain enlargements from quarter-plate to 10 by 8 with fairly short exposures. Now, compare this with my friend's previous experience. A poisonous oil lamp, giving out not only noxious fumes, but great heat, and giving (even with the aid of a piece of ground glass to diffuse the light) a very badly illuminated disc, with shadows in all directions, and requiring exposures on ordinary bromide paper up to twenty minutes. I grant that his skill in the use of an oil lamp may have been—doubtless was—very limited; still, there may be, and undoubtedly are, many who are equally unskilled. Now, with the acetylene bicycle lamp, all that is necessary is to remove the oil lamp, place some support in its place sufficiently high to raise the flame opposite the centre of the condenser, and move the lamp backwards and forwards until the light is even on the screen. I have no doubt that with a double-burnered lamp sufficient illumination would be obtained to enable negatives of moderate density to be enlarged easily up to 15 by 12 with exposures of one or two minutes.

There is one detail which may interfere with even lighting. I refer to the reflector. In my own lamp the reflector is what I may call almost matt-surfaced; but even if it were otherwise nothing would be easier than to either dull it or smoke it, and thus remove all reflections. Those who have never used an acetylene lamp I may caution never to blow it out, but to turn off the water supply and let the light die out. This will prevent the objectionable smell of the gas coming into their sanctum. One final piece of advice is this. After using the lamp for any considerable time, it is well either to throw away the carbide and replace it with fresh, or to stir the carbide well and thus get some of the fresh material on the top for the water to act on. Otherwise the surface will have become stale and caked, and the water will take a considerable time to get at the active carbide and make gas.

All this may be old to many of your readers, but I fancy it is new to a large proportion of those who are in search of a simple means of obtaining moderate enlargements in a simple and inexpensive way.

THE PERSULPHATE OF AMMONIA REDUCER.

By G. Watmough Webster, F.C.S., F.R.P.S.

It has been my experience to find that this most valuable addition to our stock of photographic materials is less known and less made use of than its virtues would seem to warrant. It is most probable that the puzzle may be solved from the want of knowledge of its peculiarities, the accounts given of its use, and the results obtained, being most conflicting. That in various hands its action has been irregular is proved by the differing recommendations as to the strength it should be made up to. We have had all the proportions given, from 1 to 10 per cent. With a uniform preparation there surely should not be such variations as this, even when we take into consideration the different requirements of professional and amateur. The latter, with fewer negatives to attend to, will think nothing of spending half an hour over a negative which he values. A professional, whose time is money, would scarcely like to spend more than five or ten minutes; further, if longer time—say half an hour—were required, the exigencies of business might tempt him to leave his negatives for a time, and possibly cause him to forget them till the reduction had gone too far. Hence, a method which should require on an average about ten minutes may be looked upon as one to be aimed at.

We have had recommendations to use the persulphate in neutral, in alkaline, and in acid condition. Here lies the crux. Let me at once say that the probable cause of all the varying opinions on the action of this chemical is to be found in its greater or less state of acidity. And this is not all. The solution, from the moment it is made, decomposes, and gradually becomes more and more acid; a good commercial sample of the salt has a slightly acid reaction to start with, but this quickly increases with solution of persulphate.

An entirely freshly made solution has but a slight action, and may be used at 10 per cent. strength with safety.

The same solution, after the lapse of a month, has a very strong action, and at 1 per cent. acts more quickly than the new 10 per cent.

That these statements may not be considered too strong, I may say that I have made a large number of experiments with solutions of various ages and strengths, and after most careful tabulation of results the figures below are given as absolutely reliable:—

If the solution be made with ordinary "tap water," which usually contains chlorides or carbonates, the action of the chemical on the film is quickly seen by a milkiness on the surface of the negative. This is so convenient a guide that I always use such water for the purpose.

Fresh 1 per cent. solution. No change in half an hour.

One day old ditto. Seven minutes before milkiness supervened; thirty-five minutes, very much reduced; one and a half hours, image almost gone.

Fortnight old ditto. Milkiness in five minutes; half-hour, greatly reduced.

Three months old ditto. Milkiness in two minutes; sufficient reduction in ten minutes.

There is another point to notice. With old solutions the colour of the reduced negative is changed to a rather sickly sepia tint, adi-actinic, but unpleasant-looking. With a one-day old solution the yellowing is not nearly so great, and the negative not so objectionable in colour.

Such facts show the persulphate to be so irregular in action that if they were not well impressed on the worker's mind he might find the use of persulphate too uncertain, and throw it up. These data will help to obviate such a result.

Many will perhaps say they would not care to employ so changeable a material. With that idea in view, I instituted a further series of experiments to get uniform action. If anyone takes the stopper out of a bottle which has held the solution some weeks, he will notice a strong odour, more like that of nitric acid than anything else, this being concurrent with the development of an acid reaction in the solution.

I made three separate batches of 1 per cent. solution, and at once acidified them with respectively 25, 50, and 75 per cent. nitric acid (S.G. 1.42). The result was almost precisely like that with very old solution. The 25 per cent. was only just within manageable action, the 75 per cent. almost dissolved the whole image in under ten minutes. When nitric acid was added to new 1 per cent. solution which had been on the negative for half an hour it was singular to note that the negative remained unaltered, though a piece of the same plate (cut off when dry), immersed side by side with the one just named, became reduced in a short time. Nitric acid being a corrosive liquid, which many workers may not care to handle, I tried the effect of the more familiar citric acid; but the result was not encouraging, the time needed to bring about reduction being considerable.

The practical outcome of these experiments would be the following recommendations:—

Keep a stock solution of, say, 10 per cent. (to be let down to 1 per cent.—i.e., about 4½ grains to the ounce—when required for use), and note on the bottle the date of making. The worker will then know what to expect. If this is considered wanting in uniformity, the following would take its place (but few photographers like to bring out scales and weights for a simple operation):—Make a fresh 1 per cent. solution, and add nitric acid in the proportion of one-tenth part of the persulphate present. It is better to keep a stock diluted nitric acid, say 10 per cent., to carry out this recommendation with ease. The data I have given will enable anyone to use this invaluable reducer with ease and certainty.

I conclude with the reminder that the moment the negative is reduced sufficiently it should be placed in a 10 or 20 per cent. solution of sulphite of soda, and allowed to remain for, say, ten minutes before washing thoroughly.

BOLTING SILK.

By F. J. Mortimer.

Bolting silk and its application when making direct enlargements has seemed quite a mysterious affair to a host of photographers for some years. Now, however, owing to the greater ease with which it can be obtained, its use is becoming more universal, so possibly a brief note or two concerning its method of use may not be out of place. As regards the silk itself, it appears to be a fine silk gauze, fairly stiff to handle, and is commercially obtainable in two varieties or degrees of fineness. The very fine variety will probably be found the most generally useful, and can be obtained up to about a yard in width

The effect obtainable with bolting silk varies according to its position in relation to the negative and paper on which the enlargement is being made, and it will be found that it is most easily employed when enlargements are made by projection rather than in an enlarging camera. For general use it will be found advisable to procure a fairly large piece of silk, larger than the biggest enargement usually attempted, and have it stretched on a light wooden frame. It can thus be dealt with very easily, while for certain set sizes when it is desirable to have the silk in close contact with the paper, use stiff cardboard with cut out openings of the required size, over which is stretched and glued pieces of the silk. The four principal positions of the silk during the exposure, are:—First. In contact with the negative, which can be done by sandwiching a piece of the silk between the film side of the negative and a piece of plain glass. The mesh of the silk is then enlarged with the image on the negative, and if a good negative has been used some fine effects are thus obtainable. Second. To keep the silk a short distance from the negative by stretching it over a piece of plain glass held in another carrier, say about ¼in. from the negative. The enlarged "grain" of the silk is thus put out of focus and gives a good granular "canvassy" appearance to the enlargement. Third. In contact with the paper itself. If the very fine variety of silk is used, practically no effect is discernible in the enlargement, unless looked into with a magnifying glass, when the fine lines give the print the appearance of a print from a half-tone block; and fourth, and probably best of all, by keeping the silk a slight distance from the paper, placing it say from 1-16th to ¼in. away, any degree of diffusion can be obtained, and moreover, diffusion of the most pleasing type, inasmuch the sharpness of the original image is undisturbed, and can be easily seen, while a secondary and soft fuzzy image is superimposed on it, giving that delightful softness to the whole print so often seen in many a well-known exhibition picture. In fact by giving a slight movement to the bolting silk during the exposure (at a distance of say, 1-8th inch) an effect is obtainable with a perfectly sharply focussed negative, that is indistinguishable from the much admired results obtainable with the Dallmeyer-Bergheim lens.

The large piece of silk stretched on the frame alluded to previously is very useful here, and can be held in place on the enlarging easel by long darkroom pins, while for placing the silk in close contact the cut out mounts with the silk attached, can be pinned right on to the bromide paper itself. The increase of exposure necessary with bolting silk is from 10 to 20 per cent., according to the distance, and lastly the silk, unless torn or materially damaged can be washed and restretched.

A RETROSPECT.

By an Old Lanternist.

In this London of ours, as in every other progressive city, there is constant change going on, the old is ever being elbowed out by the new Hardly a week passes, but we read that a certain house of historical interest, with literary associations, or of picturesque aspect is doomed to extinction. A half smothered wail goes up from a few artists and a few antiquaries, a letter of protest appears in the columns of the "Times," and in a month or two a brand new building, with its sanitary arrangements perfect, and with no ghosts, stands on the site of the old one. The men who remembered the old place and reverenced it, gradually die off, and, like the building, are speedily forgotten.

Place of amusement change like the rest, and comparatively few Londoners remember Vauxhall and Cremorne Gardens, the Surrey Gardens, the Cider Cellars, and other resorts of a more or less festive character. But there was one institution which can hardly be placed in the same class as these, and for two very good reasons. It was of much later date, and it was of such a staid character that it commended itself to the warm regard of parents and guardians. I allude to the Royal Polytechnic in Regent Street, which closed its doors in August, 1881, after a chequered career of more than forty years. Although the name still lingers over the door the building has been for the past twenty years devoted to quite another purpose.

Lantern exhibitions have become so common, thanks to Brin's oxygen and the rapid photographic output of slides. that it is difficult for anyone to realise that only a few decades ago there was only one place in London—indeed, I might say in the kingdom—where they could be seen. Country cousins coming to the metropolis would visit the Polytechnic, Madame Tussaud's, and the Zoological Gardens almost as a sacred duty. and the great attraction at the institution in Regent Street was undoubtedly the "dissolving views." These views were hand sketched and hand painted, and measured about 9 by 5 inches, the lanterns which exhibited them having 12 inch condensers. Some of them were really works of art. I call to mind those which illustrated a lecture on the Holy Land, which were copied from David Robert's splendid lithographs, a set illustrative of Mont Blanc, which passed through the lantern vertically so as to give the spectators the idea of ascending the mountain, and a set of paintings of Rhine scenery. Tradition said that the artists who executed these works received as much as £20 apiece for them, which is very likely. For there were few artists who devoted themselves to painting on glass; the work may now be regarded as a lost industry.

As to the lanterns, they were like square iron ovens, with a very powerful limelight jet, with the lime kept in rotation by means of clockwork. In the basement of the building were two huge gas holders, one for hydrogen (house gas) and the other for oxygen. The latter was, up to the very last days of the Polytechnic, generated in very primitive fashion. There was a big furnace, and the retort consisted of a thick iron mercury bottle, with an inch iron pipe screwed into it. Of course. a thin iron retort with a gas ring beneath it would have done the work better and more cheaply. But the Polytechnic was conservative in its ways, and when the building was first opened the oxygen was made from black manganese alone, which necessitated a very strong retort. Afterwards when potassic chlorate was introduced the old form of retort was retained. Pipes from the gas holders were laid all over the building, and could be tapped both in the lecture theatres and in other parts.

The "Sanctum Sanctorum" of the Polytechnic was known as the optical box, to which the public were never admitted. It was at the back of the big theatre, a large room, in which were contained the bulky lanterns and the slides. Sometimes four or five lanterns would be going full blast at the same moment, in order to produce those "effects" for which the building was famous. Here was the phantasmagoria lantern, which travelled on a small railway in a direction towards and from the sheet. By means of this apparatus the figure, say of a terrible ogre, could be made to appear to increase in size from a mere speck until it filled the sheet with its awful form. This was, of course, employed to illustrate the fairy stories, which at Christmas time formed part of the bill of fare.

There was also a reflecting lantern, or Aphengescope here, and a lecture upon watches was most beautifully illustrated by it, various old watches being shown in movement on the sheet, and in historical sequence. An apparatus of the same type was also used, with an erecting lens, to show the living human face upon the screen, a member of the staff volunteering to submit himself for a minute or so to the terrible heat of two lime jets. He used to drink the health of the spectators in a glass of sherry, and I firmly believe that if the sherry had not been forthcoming he would not have been forthcoming either. An electric lantern was sometimes used for showing the spectrum, but as its use involved the charging of a battery of 60 grove cells, it was an expensive luxury. The dynamo had not yet been devised, and general electric illumination was then but a dream.

Success breeds imitation, and the Polytechnic found itself in the year 1852 confronted by a rival show, which was started with the usual flourish of trumpets by a limited company. Their local habitation was the Panopticon, in Leicester Square, and no expense was spared to start the enterprise well. The new palace of popular science closely followed the Polytechnic model, and it was furnished with a big electric machine, a huge cylindrical tank of glass for the accommodation of a diver, who, by the way, took an electric lamp under water with him, a lecture theatre, a fountain which spurted up to the roof, a distance of 100 feet, a fountain which was illuminated with all the colours of the rainbow in the manner lately followed at the Crystal Palace, and a big organ with three claviers, so that three men could play at once! (This organ afterwards found its way to St. Paul's Cathedral, and was used for services under the dome, but it has since been taken down.) In the centre of the organ, which stood in a recess, were golden gates, and behind those gates were dissolving view lanterns which projected their pictures on a wet sheet let down for the purpose. There was a lift, or ascending room, which ran on a vertical shaft outside the galleries and gave access to each. The gentleman who described the lantern pictures was sent up in this cage, and held forth from it, as from an elevated pulpit. There were many other wonderful things in the building. But the enterprise failed, and in the year 1858 the poor Panopticon, shorn of its scientific properties, was opened as the Alhambra. The music hall entertainment proved more attractive than that which it displaced, and the building entered upon a career of prosperity which has never deserted it. The place occupied by the big organ was now the stage for comic singers and ballet dancers. There was an attempt not many years ago to start a new place of entertainment on the lines of the old Polytechnic. The money was ready, but a suitable building could not be found, and so the proposal fell through. It is a moot question whether London would now support a place of the kind. In my poor opinion I think it would. A place is certainly needed where new inventions and discoveries could be explained and demonstrated in a popular fashion, and if properly managed it ought to succeed. At the present time the public taste runs to music halls and entertainments of a very frivolous nature, but perhaps the pendulum may some day swing round, and there may be a demand for a much improved type of Polytechnic entertainment.

HINTS TO GLOSSY P.O.P. WORKERS.

By Thos. Stokoe.

First I would insist on the need for keeping dishes and hands scrupulously clean when working. The surface of the paper when wet is so acquisitive that it is ever ready to pick up what is not wanted. Still, as with every possible care some slight stain may by chance become attached, it may be convenient to know that anything on the surface may be removed by gentle friction with a soft cloth dipped in methylated spirit, and this does not injure the surface of the paper as the application of water does. Occasionally I have found a yellow spot appear in the white portion of a print which was not on the surface. These may be removed by touching with dilute hydrochloric acid of medical strength, best applied with a camel-hair brush, and then returning to the fixing solution. As a last hint, I would suggest that P.O.P. postcards should be toned, fixed, and washed face upwards. For some time I was plagued by having two or three cards of each batch spoiled, though all received same treatment. At last I came to the conclusion that those which were for any short time at the bottom of the tray were, on account of their weight, in such close contact with the earthenware that the solution was practically excluded, and the toning, fixing, or washing was consequently irregular. Since altering my method I get no spoilt postcards.

TABLE SHOWING THE ANGLE INCLUDED ON PLATES OF VARIOUS SIZES WITH LENSES OF DIFFERENT FOCAL LENGTHS.

By J. W. Salisbury.

Focus of Lens.	Sizes of Plates.						
Ins.	4¼ × 3¼	5 × 4	6½ × 4¾	7½ × 5	8½ × 6½	10 × 8	12 × 10
2½	80¾	90	97	112¾			
3	70¾	79½	94½	102¾			
3½	62½	71	85¾	94	101		
4	56	64	78¼	86¼	93½	102¾	
4½	50½	58	71¾	79½	86¾	96	106¼
5	46	53¼	66	73¾	80¾	90	100½
5½	42¼	49	61¼	68½	75½	84½	95
6	39	45¼	57	64	70¾	78	90
6½	36¼	42	53¼	60	66¼	75	85½
7	33¾	39¼	49¾	56¼	62½	71	81¼
7½	31¾	36¾	46¾	53¼	59	67¼	77¼
8	29¾	34¾	44¼	50¼	56	64	73¾
8½	28	32¾	41¾	47¾	53¼	61	70½
9	26½	31	39¾	45¼	50½	58	67¼
10	23	28	36	41¼	46	53¼	62
11	21¾	25½	33	37¾	42¼	49	57¼
12	20	23½	30¼	34¾	39	45¼	53¼
13	18¾	21¾	28	32¼	36¼	42	49½
14	17¼	20¼	26¼	30	33¾	39¼	46½
15	16¼	19	24½	28	31¾	36¾	43½
16	15¼	17¾	23	26½	29¾	31¾	41¼
17	14¼	16¾	21¾	25	28	32¾	38¾
18	13½	15¾	20½	23½	26½	31	36¾

When photographing near objects, the distance between the ground glass and the position of the stop should be taken as the focal length.

EPITOME OF PROGRESS.

COMPILED BY THE EDITOR.

THE TRAILL-TAYLOR MEMORIAL.

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THE GREAT PHOTOGRAPHIC STAR MAP.

BEING THE FIFTH TRAILL-TAYLOR MEMORIAL LECTURE, DELIVERED DECEMBER 11TH, 1902.

By H. H. TURNER, D.Sc, F.R.S., Savilian Professor of Astronomy, Oxford.

If there be a difficulty in selecting an astronomical topic on which to address photographers, it arises from the number and importance of suitable topics, and not from their scarcity. In almost every department of astronomy photographic methods are to-day in constant use, and have become indispensable. The surface of the sun is photographed daily at several observatories, and on the occasion of a total solar eclipse the observations made are chiefly photographic. The surface of the moon is being mapped and surveyed by means of photography; hundreds of new planets have been discovered by the inspection of photographic plates; pictures of comets supplied by the camera have practically superseded drawings, and in many instances provide the material for determining the orbits of these bodies; the configurations of stars and nebulæ, which were imperfectly and laboriously recorded a quarter of a centry ago by visual methods, are now caught with accuracy in a few minutes by the sensitive film; and prolonged exposures reveal to us objects of which even the existence was not previously suspected. I might go through the category of the heavenly bodies again, and point out in each case other photographic methods, as yet only imperfectly developed, which are certain to be used in the near future. In the case of the sun, for instance, Professor Hale and others have shown how we may photograph not only the spots and the ordinary solar surface, but the faculæ and prominences; and there is no reason why a daily record of these by photography should not be added to that of the spots—no reason, that is to say, beyond the impossibility of answering all the bewildering new calls on the attention of astronomers which the photographic method has made. Or, in the case of the moon, I might point to several methods of observing her orbital motion by photography, which only awaits someone with time and energy to carry them out. I might go through the category a third time, and describe what has been done with the spectroscope added to the camera; and this would take us into a department of astronomy so vast as to be practically a separate science.

With so embarrassingly rich a choice, I may, perhaps, be forgiven if I felt it hopeless to determine what would be most likely to interest my audience, and took refuge in the less ambitious but safer alternative of speaking about my own particular work. For the last nine years the Oxford University Observatory has been steadily busy on its share—a one-eighteenth share—in the making of a great map of the stars by photography; and it is my hope that some account of this work—not a complete historical summary, but rather a few notes on points of photographic importance—may interest you to-night. Fortunately for me, though the topic was selected for a personal reason, it is one of both national and international interest. The eighteen observatories taking part in the work were selected from all countries at an International Conference held in Paris in 1887, and the details of the work have been from time to time superintended by subsequent conferences of the same character. Of the eighteen partners six are British, so that our Empire is bearing a worthy share of the total burden. As an indication of the magnitude of this burden, it may be safely said that the map will not be completed within a quarter of a century of its inception; and when it is finished it will be an almost imperative duty to begin it all over again, in order that we may see what changes have occurred in the heavens since the first survey. So that the work on this great star map will absorb a considerable fraction of the total available energy of astronomers in our time.

REASONS FOR A STAR MAP.

Those unfamiliar with the needs of astronomers may reasonably ask the question: What are the precise objects in view in making a star map? The uses of terrestrial maps are well known, and the chief of them may be classified under two heads:—

(a) Maps help us to find our way in unknown regions; and without them we might run risks of the gravest kind, as when navigating a ship or marching in a hostile country.

(b) They preserve a definition of property, both individual and national.

Neither of these functions would seem capable of being discharged, in obvious counterpart, by maps of the stars. The idea of property in the central heavens is almost as ridiculous as that of danger in allowing our gaze to wander from one part of them to another; and how can we even lose our way when the whole sky lies open to our inspection? And yet there is a similarity between the two cases. With a terrestrial map we can trace our own puny journeyings to and fro; with a celestial we can follow with accuracy the sweep of the planets round the belt of heaven. A terrestrial map guards the rights of property by enabling us to recognise that some ill-doer has "moved his neighbour's landmark." A celestial map made to-day will show years or centuries hence how those celestial landmarks which we call stars have been moved, not by any malicious agency, but by the majestic flow of the celestial motions. Nay, more, we may detect the presence of some new star, hitherto invisible, which has blazed into prominence, like some submarine volcano which a terrestrial convulsion raises above the surface of the ocean; or we may detect a new planet. In the middle of the last century the planet Neptune was discovered by mathematical analysis; and the part played in this discovery by a star map was so dramatic that I venture to recall it as a striking illustration of the importance of star maps generally.

THE DISCOVERY OF NEPTUNE.

The story begins with the opening words of the immortal letter which Adams left at the Royal Observatory one afternoon in October, 1845:—

"According to my calculations, the observed irregularities in the motion of Uranus may be accounted for by supposing the existence of an exterior planet, the mass and orbit of which are as follows." (Then follow the figures.)

The planet Uranus has for some years appeared in a position which could not be deduced theoretically from the attractions of other known planets; its motion showed "irregularities." Working backwards from these with marvellous mathematical skill, J. C. Adams, then a B.A. at Cambridge, deduced the existence of a planet whose attraction was causing the irregularities; and he proceeded to give, in the remainder of the letter, approximate details of the position of the planet in the sky. From these details an astronomer armed with a star map of the region could have found the planet within a few hours on a clear night; but without a star map the labour required was much greater—in fact, practically equivalent to the construction of such a map. The positions of at least fifty stars, any of which might be the planet, must be accurately measured on at least two occasions. Now, no such map was available at Greenwich; and partly for this reason, partly also from other unfortunate circumstances which need not now concern us, the planet was not looked for. Some months afterwards Leverrier, in France, completed entirely independent calculations, and arrived at much the same result. He communicated it to a Berlin astronomer, Galle, who by this time was in possession of just the right star map; and Galle found the planet the same night. Naturally a controversy arose as to who was the real discoverer—a controversy of considerable violence in which few concerned escaped "savage abuse"* at the hands of someone. In the course of time this question was amicably settled by an equal division of credit between Adams and Leverrier; and in any case we need not consider the merits of it here. What does concern us is the vital difference which the possession of an adequate star map made, and secondly, the fact that this particular use of the map could not possibly have been foreseen when it was constructed. We learn, if we did not know it before, that we must provide for unforeseen contingencies as well as for familiar needs; and, therefore, you will perhaps be prepared to accept the statement that the most important reasons for making a star map are those which neither I nor anyone else can at present give.

EXISTING STAR MAPS.

Maps may be of various sizes, and the larger the map the more detail it is possible to insert. A map of the whole earth may be made on a sheet of note-paper, but it is not the kind of map which a cyclist would choose for finding his way about. He would prefer a map of the kind described as one mile to the inch, which would only represent a very small portion of the earth's surface, but would show the detail he requires. Similarly, a map of the whole heavens can be made on a single sheet of paper, but it is not the kind of map we should use to find the planet

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* "I was abused most savagely both by English and French." (Autobiography of Sir G. B. Airy, p. 181.)

Neptune. For this we must have a small portion of the sky mapped in considerable detail. The map which was actually used may be described as on a scale of 140 miles to the inch. Not that the sky is to be measured in miles or millions or billions of miles, but we can make this kind of comparison between celestial and terrestrial maps as follows. If maps of the whole surface of the earth were made on a scale of one mile to the inch, and combined into a globe, the diameter of this globe would be 8,000 inches (about one furlong), since there are 8,000 miles in the earth's diameter. Now celestial maps can be combined into a celestial globe, just as terrestrial into a terrestrial globe; and a celestial globe on the scale of the Berlin maps would have a diameter of only about 5ft., which is 140 times smaller than 8,000 inches, and may be called therefore a scale of 140 miles to the inch. This represents very nearly the limit of what had been done in the way of celestial map-making up to the year 1887. Some slight advance on the Berlin maps had been made by a celebrated German, called Argelander. He had made star maps which would cover the globe 7ft. in diameter; or rather *half* cover it, for he only worked at the northern hemisphere. The project I have to speak of to-night is that of making by photography the equivalent of a celestial globe 50ft.† in diameter, or what may be called on the analogy of terrestrial maps 14† miles to the inch. This is a notable advance on anything done before, though it still falls far short of what we may hope to do in the future, even if we aim no higher than the counterpart of the terrestrial mile-to-an-inch map. To illustrate the character of the advance, I may remark that while Argelander's maps are contained in a portfolio of moderate size, the photographic map will, when completed, form a pile of paper 30ft. high, weighing nearly two tons! The question of storage alone is a serious matter.

THE ORIGIN OF THE PROJECT.

The train of circumstances which led to the inception of this project begins with the appearance of the comet of 1882, the last really respectable comet which we in the northern hemisphere have been privileged to witness. It was so fascinating an object that photographers tried to obtain pictures of it; but having only ordinary cameras, which are swept round by the earth in its daily motion, they could not get any results of value. The Director of the Cape Observatory, Sir David Gill, invited Mr. Allis to strap his camera to the equatorial of the observatory, which had clockwork for counteracting the earth's motion; and some beautiful pictures were then obtained. But it is not the central features of these pictures, the comet itself, which immediately concerns us. A quite unexpected result was the appearance of a vast number of stars on the plate as well, and Sir David Gill immediately thought, why not make maps of the heavens by photography? With him to think was also to act, and he at once set about completing by photography the 5ft. globe above mentioned, of which Argelander had made the northern half. But these photographs also set others to work. Dr. Common in England showed that the nebulæ could be photographed, and in France the brothers Henry, who were slowly and laboriously making a large scale map of a small portion of the heavens by old-fashioned methods, and had almost come to a standstill at one portion thickly studded with stars, caught eagerly at the promises suggested by these comet pictures, and tried whether photography would help them. The result was a very great success, though it was not attained without immense labour, skill, and the courageous support of Admiral Mouchez, the Director of the Paris Observatory, who made light of administrative difficulties. But when once satisfactory results were obtained, they were so completely successful that it seemed imperative to complete, not only the original project of the Brothers Henry, which included only a small portion of the heavens, but a map of the whole sky on the same scale.

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† These figures apply to the Enlargements, which are twice the size (linear) of the plates.

THE CONFERENCE OF 1887.

For this, however, co-operation was necessary. To cover the whole sky with plates of the kind they were taking would require a total of 11,000 plates; and it was beyond the power of a single observatory to obtain these in a reasonable time. Accordingly Admiral Mouchez and Sir David Gill called together an International Conference at Paris in April, 1887, which was attended by eminent astronomers from different countries as follows:—France 20, British Empire eight, Germany six, Russia three, Holland three, U.S America three, Austria two, Sweden two, Denmark two, Belgium one, Italy one, Spain one, Switzerland one, Portugal one, Brazil one, Argentine Rep. one. Many of the decisions of this Conference, arrived at after hard work and earnest discussion, and decisions which have had an important effect not only on this particular work, but on the progress of astronomy generally, we have not the time to consider to-night. It must here be briefly stated that 18 observatories were chosen to share the work: that they were all to use a standard pattern of telescope, similar to that which the Brothers Henry had adopted (giving a scale of one minute of arc to a millimetre; or in the terms already made use of, a celestial globe of 25 feet in diameter); and that the sky was to be covered four times over, twice with plates of long exposure (originally defined as 20 minutes, subsequently extended to 40 minutes, and ultimately in some cases to an hour), and twice with plates of short exposure; thus giving about 1,200 plates of each exposure to each participating observatory. But two of the decisions are of great interest to photographers, and I propose to dwell on them specially.

THE RESEAU.

The first is something of a curiosity from the fact that it was arrived at with one object in view, and has served for another. It was decided to put what is now familiarly called a *réseau* on the plates, a series of accurately ruled cross lines 5mm. apart. I need only explain to photographers very briefly how this is done. Either before or after exposing a plate to the stars, it is placed behind a plate coated with metallic silver, in which the *réseau* of lines has been carefully ruled so as to cut away the silver; and exposed to a faint artificial light for a few seconds. On development both star images and *réseau* appear. The original object of this process was to guard against distortion of the film by development: for if such distortion occurred, not only the stellar configurations but the *réseau* also would be distorted; and the errors could be detected and allowed for. But experience has shown that no sensible distortion occurs in this way. If anyone is tempted to think that this result might have been foreseen, I would remind him that this result might have been foreseen, I would remind him that astronomers are concerned with displacements of extreme minuteness; and although it was previously known that there was no considerable distortion, there might have been small defects which no photographer would have, hitherto, been troubled by, and which would yet have embarrassed the astronomer greatly, unless precautions were taken against them. Fortunately, none have been found: and. fortunately, they were guarded against in this way, for the *réseau* has proved an incalculable advantage for a quite different purpose. It enables us to measure the position of any star on the plate with great ease. It does for us what the hour hand or the minute hand of a clock does as regards time; these break up the plate into small pieces, and to specify the exact moment we have then only to watch the seconds and fractions., So the *réseau* lines break up the plate into small squares which we can recognise by merely counting the divisions; and to obtain the exact position of a star we have only to supplement this by measuring its position in its square. The labour thus saved is, perhaps, only to be realised by actual experience; but anyone who has had such experience knows what we owe to the happy, though so far mistaken, idea of guarding against distortion in development by using a *réseau*. I will add that, if for any purpose whatever a photographer wishes to measure the positions of objects on a plate he cannot do better than use a *réseau*, which has now become a commercial article. A silver matrix costs a few pounds, but any number of photographic copies can be made from this matrix at the mere cost of the plates; and if the photograph to be measured has no *réseau* lines already on it, one of these *réseau* copies can be bound together in contact with it, film to film, which is almost as convenient as, and somtimes better than, having the lines actually on the picture itself.

Choice of Instrument.

The second decision of the Conference to which I would direct special attention is perhaps the most important of all: I mean the choice of the instrument to be used for taking the plates. To a non-astronomical photographer the choice of a lens has a restricted meaning; there are plenty of lenses to choose from certainly. but they are all what we call doublets, made up of two pairs of lenses, with a space between, in which the stop is put. The photographs of the comet of 1882 at the Cape of Good Hope were taken with a lens of this kind; but those whom they stimulated to work adopted different types of instrument, because they wanted large instruments, and to make a large doublet is very costly. Each of the four lenses in a doublet has two faces, and to make eight glass surfaces optically true on a large scale is a serious matter. Dr. Common contented himself with one surface, reflecting light to a focus. His beautiful photograph of the Orion nebula, which obtained the gold medal of the Royal Astronomical Society in 1883, was taken with a reflecting telescope of 3ft. aperture, which he obtained at a moderate cost. It is doubtful whether a doublet of this size can yet be made successfully; and when, in 1889, Prof. E. C. Pickering, of Harvard, was enabled by the liberality of Miss Catherine Bruce to obtain one of 2ft. aperture, the sum placed at his disposal was £10,000. If instruments of this class had been adopted as the standard pattern by the Conference of 1887, eighteen observatories would not have been forthcoming as co-operators, nor eight; perhaps not even two. The pattern adopted was such that the actual camera could be purchased for less than £600; this, at any rate was the sum presented by the late Dr. Warren De la Rue to the University of Oxford, to enable its observatory to take part in the work, and this sum provided for a camera 11ft. long, with a lens of 13in. aperture, and for its attachment to the already existing equatorial mounting. The optical part of the camera is neither a doublet of the kind familiar to photographers, nor a reflector of the kind used by Dr. Common; but a single lens (or rather pair of lenses), resembling the object glass of an ordinary telescope or a "landscape" lens, without any diaphragm. It was of a pattern arrived at after much experimental work by the Brothers Henry, who had, like Dr. Common, been stimulated by the Cape photographs to see what photograph could do, and had, like him, chosen their own form of instrument; but, unlike him, had chosen what is called a refractor, instead of a reflector.

When the Conference met in 1887 they had, in fact, to make a choice between these three types of instruments, the doublet, the reflector, and the refractor. All three had been tried and found successful in different ways, but the information available, especially as to the accuracy of each, was very scanty. It may be stated in tabular form somewhat as follows:—

	Reflector.	Refractor.	Doublet.
Number of optical surfaces (determining cost to a great extent)	1	4	8
Thickness of glass ... (meaning loss of light)	0	1	> 2
Available field	< 2°	> 2°	> 5°
Accuracy	Good	Good	Unknown in 1887

From this statement it is seen that the doublet is undoubtedly the most costly, and there is a risk of loss of light: for not only are two compound lenses to be transversed, but a diaphragm or stop is generally inserted between the lenses, which cuts down the effective aperture. Hence I have represented the loss of light by the symbol for "greater than 2" as compared with the single lens of the refractor. On the other hand, the doublet has a much larger field than the others. At the present time it is rather difficult to put any definite limits to the possible field, and even in 1887 it was known that 5 degrees could be obtained. To realise the nature of this advantage, it must be remembered that the larger the field which can be covered at a single exposure, the fewer exposures are necessary to cover the whole sky. With the adopted instrument the diameter of the available field is 2 degrees, and 11,000 plates are necessary to cover the sky; but if the field could have been extended to 5 degrees, the area covered by a single exposure, which varies as the square of the diameter, would have been increased in a ratio of 25 to 4, or more than 6 to 1, and the number of requisite plates diminished therefore to less than 2,000. This is such a striking advantage that we should expect it to be the determining factor in the choice, and when we are told that the refractor was selected in preference to the doublet, we naturally inquire what was the weighty consideration which could set aside so manifest a gain. We find it in that terrible spectre, "the Unknown," which scientific men are sometimes as reluctant to face as are all other living things. The accuracy of photographs taken with a doublet was unknown, and was accordingly mistrusted. The very fairness of the promises held out gave rise to an uneasy suspicion that there was treachery somewhere. So great was the mistrust that in the debate on the choice of instrument, in which twenty-six eminent astronomers took part, the doublet was never even mentioned, the discussion being confined entirely to the relative merits of reflector and refractor. Prof. E. C. Pickering, of Harvard, had sent a letter advocating the use of a doublet giving a field 5 degrees square, but he had no definite information to give as to the accuracy obtainable with it, and his letter attracted no attention. The keynote of the discussion was struck by the veteran astronomer, M. Janssen, in advocating the adoption of an instrument similar to that used by the Brothers Henry, when he said: "On sait ce que cet instrument peut donner, il a fait ses preuves."

M. Janssen cannot be called an over-cautious man. He it was who, during the Siege of Paris, in 1870, left the city in a balloon with his telescope, because he wished to observe the total solar eclipse of that year. He it is who has planted an observatory on the top of Mont Blanc, a hazardous enterprise for a man past three score years and ten. But in a great work like the astrographic chart, he felt that we must be not merely hopeful, but certain, of our instrument, and as no one could present an unexceptionable character for the doublet, it was passed over in favour of the refractor.

We know now that first-rate credentials could have been presented if only someone had had time to make the necessary comprehensive tests, and I should like to say a few words on this point, however superfluous it may seem for an astronomer to commend to photographers their own familiar instrument.

ACCURACY OF THE DOUBLET.

In the first place, then, the doublet shows star images (and, of course, other objects) in their true positions on the plate, with an accuracy equal to that of the refractor, and probably greater than that of the reflector. This statement must be qualified by the admission that the accuracy of these instruments has only been tested up to a certain point as yet. For the purposes of the star map, it has not been possible to make measures of the greatest accuracy, because we have so many stars to deal with; we aim at measuring the position of a star image on our plates within about the ten thousandth of an inch, and up to this point it has been found that over a field 5 degrees in diameter the doublet is as accurate as the refractor adopted for the star map. The details of this investigation* are too technical to give here, but I may mention that it was carried out at the Oxford University Observatory, by measuring plates kindly lent by Professor Pickering, who had advocated the use of the doublet in 1887, and it was pleasant to be thus able to confirm the excellence of his advice.

UNIFORMITY OF ILLUMINATION.

But there is another way in which the doublet is accurate, and actually superior to the refractor: it spreads star images over the plate uniformly. I have already referred to the *réseau*, the network of crosslines which is put on all the plates of the star map. It divides up the plate into little squares of exactly equal area. If we take a single plate on which a number of stars has been photographed, some of these squares may contain no stars at all, others one, two, perhaps four or five; the stars are scattered irregularly, and there will be no approach to uniformity of distribution. But if we take 100 plates or 1,000 plates, and count all the stars which appear in any given square of the *réseau*, then the accidental irregularities of distribution disappear; and with an ideal lens we should hope to find the same total number of stars credited to each square of the *réseau*. This operation of counting the number of stars on a plate is one which is going on every day in the University Observatory, as a preliminary to the measurement; it is found to be a useful check on the quality of the photograph—if there are not enough stars, according to expectations which I need not here explain, it is only waste time measuring, and better to take another plate. The counting is quickly done—we use a "billiard marker" to click off the stars mechanically—and tells us at once if the plate is good enough to measure. And having, therefore, the counts of stars on many hundred plates, it occurred to me to inquire whether the average distribution of the images over the little squares of the *réseau* was uniform, as one might hope. It was soon seen that it was not—there were fewer stars at the edges than in the centre; but what seemed more surprising, the maximum number of stars per square was not at the centre, but in a ring about 1½in. from it (the plate being about 6in. square). Was this a peculiarity of this particular object glass? Other plates taken at Paris, Algiers, Toulouse, and San Fernando with similar instruments were examined, and it was found that in each case the stars were thickest in a ring round the centre, being fewer both within and without this ring, though the diameter of the ring was not always the same. Comparison of the results led to the conclusion that the plates in each case are placed so as to be in accurate focus for the particular ring which shows most stars, the centre of the plate being thus slightly within the focus, and the edges slightly without. The rate at which the number of stars falls off as we leave the locality for true focus is the same for all these instruments, and if the plate were placed so that the centre was in best focus, the falling off would be as in the following table:—

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* See Monthly Notices of the Royal Astron. Soc., LIX., p. 439.

For 100 stars per unit area at the centre there

would be	96	,,	,,	at 20 mm.	from centre.
	84	,,	,,	at 40 mm.	,,
	64	,,	,,	at 60 mm.	,,
	36	,,	,,	at 80 mm.	,,

Now this falling off is very decided, and shows that the lens does not cover the plate of 2 degrees square with any approach to uniformity. By putting the plate rather within the focus for the centre, we may improve things a little, but the defect seems to be inherent in the instrument. Since the paper* drawing attention to it was written, plates taken with the Potsdam instrument have been counted quite independently, and similar results found; so that we may accept it as characteristic of plates taken with refractors. But the doublet is apparently free from this grave defect, or, at any rate, can be rendered free from it. When counts are made on the plates taken at the Cape of Good Hope, which have been already mentioned, it is found that equal areas in any part of the plate show the same number of stars, and this for a field not 2 degrees squares, but 5 degrees square—six times the area. This must be accounted a conspicuous advantage of the doublet over the refractor, and undoubtedly over the reflector also, which is known to be even a greater sinner than the refractor in this respect. The reason of the loss of star images is perhaps too obvious to need explanation: when the light of a faint star is not brought accurately to focus, but is spread over a small area of the plate, it is rendered too faint to affect the film, and the star is lost. It would thus appear that with a doublet the focus can be tolerably exact over a large part of a flat plate, while with a refractor it is definitely restricted—in other words, the doublet can be made to have a really flat field, while that of the refractor is curved. Probably, therefore, curved plates would suit the latter better than flat plates, and some experiments have already been made with curved plates for both refractor and doublet, though I have not time to dwell upon them here.

Indeed, I am aware that I have already somewhat digressed from my main theme; but the considerations determining the choice of an instrument for photography occupied so much of the attention of the late Mr. Traill Taylor, in whose honour these Lectures are given, that I will venture to make a few more remarks upon the topic before leaving it.

THE HARVARD STAR MAPS.

In the first place, Professor Pickering, who recommended the use of the doublet for the star map in vain, nevertheless had the courage of his convictions. He has had several such instruments at work for some years, one the veritable giant already referred to, of 2ft. aperture and 11½ft. focal length. Some of them cover a field much more than 5 degrees in diameter: he has sent me plates of diameter 40 degrees and more; and though on measurement the images on these large plates are not free from displacement or distortion, this displacement seems to follow a regular and simple law which need not seriously interfere with the accuracy of measurement. Experiments on this point are, however, scarcely yet completed. As one consequence of being able to photograph so large a field at once, Professor Pickering has been able to chart the sky *many times over,* while the eighteen observatories have been laboriously doing it once: and we have yet to learn whether our more laborious methods have really any advantage over his rapid one. It may be that a "leap-in-the-dark" in 1887 would have saved us much and cost us nothing, except the anxiety of making it. But we must remember that Professor Pickering has not measured the stars, which is a labour independent of any process of taking the plates, and really does require the co-operation of many observatories. It is only for the taking of the plates, especially those of long exposure, that I think we should do well even now to adopt his advice.

BARNARD'S PORTRAIT LENS.

Secondly, I must make some reference, though it be but a mere passing mention, of the beautiful photographs taken by Professor E. E. Barnard with a portrait lens. As a boy Professor Barnard worked in a photographer's studio in Tennessee, and was familiar with every detail of portrait photography. But astronomy attracted him, and he became so skilful a discoverer of comets that at one time, having no other means, he supported himself entirely on the sums of money awarded in recognition of such discoveries. When the great Lick telescope was set up on Mount Hamilton he was offered a permanent appointment as one of the observers: and with this great telescope he discovered the tiny fifth satellite of Jupiter, which few people beside himself have ever seen. But he could not have the use of the great telescope every night, for various observers took turns, and he looked about for something to do on the night when it was not his turn. Among the miscellaneous property of the Lick Observatory he found a good portrait lens by Willard; and the memories of his early days coming back to him, he determined to try what sort of pictures he could get of the stars. He attached it to a disused equatorial mounting and set to work; and the results were marvellously beautiful. His pictures of the Milky Way are wonderful revelations of the structure of that wonderful region, and by making long exposures he discovered extremely faint nebulosity covering vast areas where it had never been suspected; nay, where its existence was at first stoutly denied by others who could not obtain a trace of it with instruments apparently more powerful. But there came an unfortunate moment when Professor Barnard must leave the Lick Observatory: and again a fortunate moment when he was called to the Yerke's Observatory near Chicago, where a still bigger telescope had been set up. Here he is now happily and successfully at work, with this exception—the Willard lens had to be left behind him in the Lick Observatory, and he cannot get another like it! He may be said to have searched the world for such a lens; for after trying all over the United States a couple of years ago, he came to Europe and tried several of the best makers' without success. I would have you remark that it is no mere question of taste or fancy in such a case: photographs of the stars supply absolute tests of the most delicate kind. I have already mentioned a numerical test which shows that the field of a doublet is more uniform than that of a refractor: the test which Professor Barnard applied to various lenses was also numerical; he tried which lens would, with a given exposure, show most stars; and he could find no lens of equal aperture equal to his Willard lens.

WHERE ARE THE OLD LENSES?

This lens was a product of the old days of wet-plate photography, when rapidity could not be obtained in the plate, and it was all-important to have it in the lens. It is essentially a very rapid portrait lens of which Professor Barnard is in search, and it almost seems as though the art of constructing really rapid lenses had been lost in the few years since the dry plate has been invented. But, even so, where are all the old lenses? Has anyone such a lens in a lumber room? There may be some possessing such lenses, and having no further use for them—large rapid portrait lenses dating from the old wet-plate days. These are the lenses which can be turned to good account in photographing faint widely diffused nebulæ, and which astronomers such as Professor Barnard would find almost invaluable; and before they are, perhaps, lost sight of altogether, I would earnestly beg the attention of photographers generally to this astronomical need.

COLOUR SCREENS.

Thirdly, while on the subject of instruments for photographing the stars, I feel sure that an audience of photographers will be interested to learn that a simple device has recently been successfully used to transform a visual telescope into a photographic one. If we remove the eyepiece of an ordinary telescope and put a sensitive film at the focus, we might get a photograph, but it would be a wretchedly bad one, because the lens is arranged to focus the yellow or visual rays, and not the violet rays which are most photographically active. Hence existing large telescopes cannot be used as they stand for taking photographs. Various devices have been suggested for adapting them to photography: the most direct and most costly is to have an entirely new object glass as in the large Paris telescope shown in the Exhibtion of 1900; or an additional lens as in the Lick telescope; or to reverse the crown lens of the ordinary flint and crown combination, and alter the separation of the lenses, as in the 28in. refractor at Greenwich; or to have some correcting lens near the focus. All these methods have disadvantages of a serious kind. Mr. Ritchey, of the Yerke's Observatory, has adopted the much simpler plan of photographing with the yellow light, which is focussed, and stopping out the light which is not. He uses a yellow colour screen just in front of the sensitive film, and, of course, iso-chromatic plates. His pictures of the Moon with the great Yerke's telescope under these conditions are the best that have ever been taken; and he gets also wonderfully fine pictures of star clusters. The drawback to the method is that the exposure required is rather long, so that it is not applicable for faint objects; for these, however, we can use reflecting telescopes.

I have said enough, perhaps, to show that the problem of the instrument to be used in photographing the stars is one of great complexity, and if the decision arrived at in 1887 with very imperfect knowledge was not quite the best that could have been arrived at, we may at least be thankul that it was no worse.

Progress of Map.

We must now turn to the work on the great map itself, which is, I am glad to say, being made, though only slowly. In 1887 the time for completing the whole map was talked of hopefully as, perhaps, so little as five years. Fifteen years have elapsed since 1887, and some of the eighteen co-operating observatories have scarcely yet made a start, though others are happily well advanced with their work. It must be remembered that the resources of the eighteen observatories are widely different: for though many of them are national observatories, with Government subsidies behind them, the resources of Governments vary. In 1900 three of the original eighteen had made no start at all, were proclaimed defaulters, and were replaced by three others; and though these are setting vigorously to work they have not yet had time to do much. Indeed, the programme proposed is such as to strain the resources of the most wealthy observatories, and valuable time has been lost in consequence. But still, much has been done. The last general report of the state of the work was formulated in 1900, and is as follows:—The three observatories Monte Video, Cordoba, and Perth (West Australia) are those which have replaced the three defaulters, and thus their blank record is no discredit:—

Observatory.	Number of		
	Fields Assigned.	Catalogue Plates Measured.	Chart Plates Taken.
Greenwich	1,149	608	1,076
Rome	1,140	15	106
Catania	1,008	36	—
Helsingsfors	1,008	380	?
Potsdam	1,232	250	—
Oxford	1,180	736	—
Paris	1 260	650	97
Bordeaux	1,260	293	17
Toulouse	1,080	135	45
Algiers	1,260	497	56
San Fernando	1,260	145	664
Tacubaya	1,260	203	—
Monte Video	1,260	—	—
Cordoba	1,360	—	—
Perth (West Australia)	1,376	—	—
Cape of Good Hope	1,512	106	1,134
Sydney	1,400	?	—
Melbourne	1,149	?	575
Total	22,154	4,054	3,770

It will be seen that less than one-fifth of the work had been done in 1900. Of course, much time has been spent in experiments, and the pace ought to improve rapidly, but there is ample room for such improvement if the whole is to be completed within a reasonable time; and it would be affectation not to admit that there is cause for grave anxiety on this head. But it will be more cheerful for us to-night, instead of dwelling on the slow pace of the work, to turn to some of the results which are already beginning to come out of the measures, and as an example I will take some results which we have obtained at Oxford, because I know most about them.

MAGNITUDE EQUATION.

About 14,000 of the brighter stars in the zones now being photographed at Oxford were observed with the transit-circle at Cambridge about twenty years ago, and when we have measured the positions of these stars on our plates it is our first business to compare them with the positions found at Cambridge. When this is done for thousands of stars, a peculiarity of the Cambridge observations is made manifest. It is found that when the position of a bright star is determined by observing its transit—*i.e.*, the instant of its passage over several spider-lines—the observer nearly always records the instant too soon—*i.c.*, sooner than he would for a faint star. This was known before the days of photography, for their are other visual methods of finding the relative places of stars without observing transits at all. With the heliometer, for instance, we can measure the distance between a bright star A and a faint star B, when both are kept apparently at rest, and find it to be, say, exactly five seconds. But if now we "take transits" of A and B, and A comes to the wires first, the interval will be recorded as greater than five seconds; if B comes first, the interval will be less than five seconds; showing that in both cases the bright star A was observed too soon. Nearly all observers have this peculiarity, though not to the same extent, and it is called their "magnitude equation." We have heard of "personal equation," which has become almost a household word, though it originally meant that one observer records a transit systematically before or after another. "Magnitude equation" is not concerned with the difference between one observer and another, but between the observation, by the same person, of a bright star and a faint star.

Now photographs have no "magnitude equation," and when the Cambridge transit observations were compared with our plates it became very clear, not only that the transits of the bright stars had been observed too early, but how much too early they had been observed. In 1899, as the result of a comparison of about 5,000 star places, the following results were published, showing the Cambridge "magnitude equation" as determined in this way. Taking the faintest stars observed at Cambridge as correct (though we have no means of saying which class of stars is observed correctly; we only know the differences), we get

If stars of magnitude 10·0 are observed correctly,
S
then stars of magnitude 9·0 are 0·10 too early.
,, 8·0 are 0·16 ,,
,, 7·0 are 0·19 ,,
,, 6·0 are 0·21 ,,
,, 5·0 are 0·23 ,,

(The magnitude of a star is a measure of its brightness, each magnitude being 2½ times brighter than the next.)

It will be seen that the peculiarity is by no means the same throughout the scale of magnitudes, but is always in the same direction.

Now, the photographs from which these results were obtained were taken some seventeen years after the observations had been made at Cambridge, and the question arises, had the stars moved in the meantime, and, if so, would this motion affect the results? It is certain that many of the stars had appreciably moved: all the stars are in motion, though at their huge distances the movements are scarcely perceptible. But it does not necessarily follow that these motions would affect the above results; this only follows if the movements of bright stars are systematically different from those of faint stars, and there did not seem to be any reason to suspect this until about six months ago, when Sir David Gill announced that he had found such a difference in a belt of the heavens in the southern hemisphere. By comparing observations of stars in this belt, made at intervals of twenty years, he found that the bright stars seemed to be rotating round us, if we regard the faint stars as fixed. If this result were true of the whole heavens, it would involve the most serious consequences. Not only would it reveal perhaps a swirl or whirlpool in the universe of stars, but it would directly affect such eminently practical matters as the length of the year. We consider a year elapsed when the earth has travelled completely round the sun, so as to come opposite the same star again, but if the star has been moving in the meantime, we must modify our figures. In view of the vital importance of the question, it was felt that the Oxford measures must be examined from this point of view at once, and the form in which the question presented itself in this instance was simply this:—Some of the plates were taken at Oxford as early as 1892, some as late as this year, 1902. Suppose we compare the earlier plates with the Cambridge observations, do we get exactly the same result as by comparing the later? If we do, then there is no systematic motion of the brighter stars in this region of the heavens; if we do not, there is such a motion. The two comparisons were accordingly made, and were found not to give the same result, but differences somewhat as shown in the following table:—

	Cambridge Magnitude Equation.	
	From Oxford Measures in 1894.	From Oxford Measures in 1899.
	S	S
Magnitude 6·0	0·21	0·19
,, 7·0	0·19	0·18
,, 8·0	0·16	0·15
,, 9·0	0·10	0·10

It will be seen that there is a difference of 0s.02, or one-fiftieth of a second of time, between the results for stars of magnitude 6.0, taken at five years' interval. The quantity is extremely small, and those unfamiliar with such matters may be inclined to dismiss it contemptuously, as beneath notice, or perhaps be sceptical as to whether it can be relied upon. I am confident that it can be relied upon, for reasons which it would take too long to give here; and this small fiftieth of a second tells us several most important facts, for nearly all the most important facts of astronomy come from small differences like this. It tells us, firstly, that the bright stars in the northern hemisphere are moving, with respect to the faint, at about the pace which Sir David Gill found in the southern hemisphere; secondly, that they are going the opposite way to his bright stars, so that we cannot extend his result to the whole sky—that is, there is no general swirl or whirlpool, such as he suggested, and for the present we need not be anxious about the length of the year; thirdly, it suggests that we must look for another cause for both facts, and at the present moment I think such a cause has been found. The hypothesis is still on trial, and this brief mention must suffice at present.

CONCLUSION.

Enough has, however, been said to show that the great star map has not only a mere distant prospect of being useful: it is immediately wanted for the solution of pressing and important questions. It is true that these questions have only just arisen, and were not definitely foreseen in 1887, when the star map was projected. Even so when Hour XXI. of the Berlin charts was being constructed, no one foresaw that it would be wanted almost immediately for the discovery of Neptune. As already remarked, the most important uses to which scientific work will be put are seldom foreseen; we must work on in faith that the work will be valuable, but in a faith founded on solid results of past experience.

But it may be asked, if we can never foresee the best results of our work, how can we tell what is the best thing to do? Instead of making a star map, why should we not photograph a certain square yard of the ocean every half-hour, and study the changes in it; or with a microscope photograph as many individual grains of sand as we can, and study the varieties of form? Who can tell what the ultimate result will be? My reply is that I do not think anyone can tell: I do not think there is in the nature of things any criterion which can tell us the value of any patient accumulation of facts, or assign a limit to the accumulation beyond which it becomes valueless. The only limits or reasons for selection which I know of are essentially human: if you work at certain things, you will get little human sympathy at present; if you attempt accumulations on too vast a scale, you will not have money enough; and, again, you may prefer to reach conclusions from your facts within the short spell of a human life. In human enterprises such considerations are determining factors, and in the particular case of the great photographic star map I am not sure that they have received sufficient attention. The question of the scale of the map is one of expense simply. No astronomer doubts for a moment that it would be better to make a 500ft. globe than a 50ft., if we had the money. No astronomer doubts for a moment that it would be better to measure the plates elaborately four or five, or fifty times over, if we had the time. We must consider available time and money, and the fact already mentioned that the work is going on rather slowly is a result of not considering these important matters sufficiently.

But I hope to have made it clear that a great work is being carried out, from which we may expect great results, a work scarcely dreamt of thirty years ago—to-day, not only possible, but comparatively easy of accomplishment. Photography owes something to a great astronomer, Sir John Herschel, who was the first to obtain photographic pictures on glass; but it has made an ample return, for among the debts of gratitude incurred by one science towards another, it would be difficult to find one greater than that which astronomy is proud to acknowledge towards photography, for that beautiful and simple invention which has rendered the great photographic star map a possibility—I mean, of course, the invention of the photographic dry plate.

HALATION.

(A Paper read before the Birmingham Photographic Society, January 21st, 1902, by HAROLD HOLCROFT, M.A., F.C.S.)

Quite a number of unwelcome appearances upon the negative are popularly classed under the head of "Halation," but, strictly speaking, true halation should be traced to two causes only. (1) The first is the lateral spreading of light in the film itself; and (2) the second cause is the reflection of light from the internal back surface of the glass or other support of the sensitive film. Although it is convenient to consider these two causes separately, they have one common origin. Imagine that we have a black card with a small hole in it placed before the camera with a bright light behind the card. If now we focus this bright point of light upon a sensitive plate, we shall have the film illuminated with a bright spot. This bright spot becomes a centre of emission and radiates light in all directions; some rays travel forwards, and are, or should be, absorbed by the dead black interior of the camera, and concern us no further. Other rays travel backwards through the film itself into the glass plate, where they undergo partial or total reflection at the back surface of the glass, and cause the second variety of halation, which we will deal with presently. Other rays travel laterally from the bright spot for some little distance into the substance of the sensitive film, which is not very opaque, and produce no actinic effect like a halo about the image of the point. It will be obvious that the amount of halation must increase with the brightness of the image and also with the length of exposure. Therefore, when both these are considerable, as is frequently the case in the photography of interiors, where there is a clear glass window in the field of view, together with dark details, which require a prolonged exposure, the halation must necessarily be at its worst. From a consideration of these rays which radiate laterally, it would appear that it is almost impossible to have a clean image in any case; but fortunately, in ordinary work, their effect is slight enough to escape notice unless it is sought for. But even if the light is not very bright, this form of halation is sufficiently obvious when, as in the present case, the bright point of light is adjacent to a dead black part of the image. The lateral spreading of light in the film is one of the reasons why it is difficult to copy a line drawing with perfectly clean lines, such as process engravers require. This variety of halation, it should be noted, is chiefly in the upper layers of the film, and the best remedy appears to lie in the direction of increasing the actinic opacity of the film.

THEORETICAL CONSIDERATIONS.

The addition of iodides to the emulsion is one practical plan, which is in general use. Another plan consists in staining the film with non-actinic colours. Mr. W. K. Burton experimented with picric acid and picrate of ammonium with more or less success; he found that the chief drawback to their employment lay in the fact that the sensitiveness of the film was lowered. The practice of process engravers to get over the difficulty consists in clearing the lines with a reducer, intensifying afterwards if necessary to restore the opacity of the negative. The effects of this lateral spreading of light can also be minimised somewhat by painting the spot with a solution of an alkaline bromide during development, which allows the image to develop relatively faster than the halation. Let us now return to the image of the spot of light, and consider the second form of halation which is due to the reflection of the rays. In the ordinary practice of most photographers the effects due to this second cause are much more serious and obvious than those due to lateral spreading, since with glass plates of the usual thickness the reflected halation extends for a comparatively wide range round the point of light, whereas the lateral halation is confined more closely to it. It must not be overlooked that both forms of halation co-exist if the second form is present; that is to say, if the light does penetrate right through the film, it must also be able to spread laterally.

The diagram No. 1, which represents an imaginary section of a dry plate highly magnified, illustrates the simple case of the path of some of the rays which diverge from the bright spot on the film marked O into the glass plate. The general law for these rays may be stated as follows:—When a ray of light passing from glass to air, strikes the surface which is common to both perpendicularly, the ray is almost wholly transmitted; very little of it is reflected; but as the angle at which the ray falls differs from the normal, so does the proportion of the light which is reflected gradually increase, and that which is transmitted decrease. When, however, a certain angle dependent upon the refractive index, and called the critical angle, is reached, the light is suddenly entirely reflected. In the diagram the perpendicular ray OX passes almost completely through the glass, emerging in the direction of Y; very little of it is reflected. The rays OA, OC, OE are internally reflected in the directions B, D, and F respectively; but OA is also partially transmitted as well; the same is true of OC, but the reflected portion is greater, and the transmitted less. The ray OE is supposed to fall at the critical angle, so that the whole of it is reflected. Any rays falling beyond E are also totally reflected, but the more the rays extend in this direction, the longer is their path through the substance of the glass, so that they suffer considerable absorption and lose in actinic power. As the rays radiate in all directions round the point O, the result is a ring of halation round the point O, which is slightest at the centre, vignetted at the circumference, and densest at some intermediate point. It should be noted that this second variety of halation, unlike the first, produces its effect entirely upon the lower surface of the

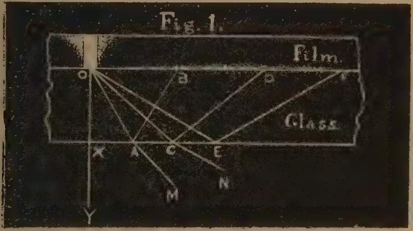


Fig. 1 shows the course of the rays which produce reflected halation. The dotted portions show the positions of the lateral and reflected halation.

sensitive film, and is clearly visible at the back of the plate before fixing; every photographer must have noticed it.

THE PRINCIPLES INVOLVED.

In explaining the theory of halation, the case of a single point of light has been taken for the sake of simplicity, but the reasoning can easily be extended by remembering that an image is but an aggregation of a number of points. A consideration of the diagram No. 1 will show the different plans of attack for preventing or minimising the halation from reflection. There are at least five principles which may be adopted:—1. The sensitive film may be made as opaque as possible, so that little or no actinic light is transmitted, consequently there is none to be reflected. This is done by the addition of iodides to the emulsion, or by increasing the thickness of the film (it is always well to see that the plates have a generous coating of emulsion), or the films may be treated with non-actinic dyes. Several distinct layers of film may be superimposed, as in the Sandell plates; or an opaque or non-actinic substratum may be interposed between the film and the glass, as in Oakley's anti-halation plates, which substratum is cleared away during development or fixing, or afterwards. 2. As a second principle, reflection from the glass may be abolished by discarding the glass plate, using a paper support, stripping or otherwise, or a cristoid film, which dispenses with a support altogether; or the amount of halation may be reduced by using a thin, transparent material like celluloid, as a support, which limits the spreading of the light by reflection. A moment's consideration of the diagram No. 1 will show that the thinner the transparent support, the smaller will be the area of the ring of reflected halation round any point. The converse also is true; a glass plate thicker than usual will be found to spread the halation over a wider area. In either case, the total amount of halation is the same, but its intensity will vary inversely as the area if the absorption of light due to the support is neglected. When the support is very thin, the reflected halation practically coincides with the image, and reinforces it. 3. As a third principle, the amount of halation can be minimised by reducing the excessive contrast of light and shade falling upon the plate by covering up the high lights for a portion of the time of exposure. In photographing difficult interiors, when a window cannot be managed in any other way, a cloth is sometimes hung outside the building over the window for a part of the exposure. There is another way of effecting the same end, by means of a skeleton wire frame fixed a short distance in front of the lens, by means of which pieces of opaque paper cut to proper size and shape are fixed so as to cover up the high lights for part of the time; this method is described in "The Photogram" for April, 1897. 4. A fourth principle consists in taking advantage of the fact that the image is mainly on the front of the film, while the reflected halation is on the back surface. If the developer can be confined to the upper layer of the film, the halation below will remain undeveloped. This is accomplished by a preliminary soaking of the film in plain water to saturate the gelatine and delay the entrance of the developer; then a strong developer is applied to the surface for the minimum of time; if necessary, the solution can be poured away before full density is attained, and a physical developer substituted. An addition of a colloid such as gum to the developer assists in confining the action to the surface. It will be seen that a full exposure is required, as the action of the developer must not be prolonged in the attempt to force out detail. 5. The fifth principle consists in what amounts to temporarily abolishing the back surface of the glass support, so that no reflection can take place therefrom, and substituting an absorptive body to trap the actinic rays. This is done by coating the back of the glass plate with a medium which is in optical contact, which has the same refractive index as the glass, and which is capable of absorbing all actinic light which reaches it.

BACKING THE PLATE.

This backing of the plate is perhaps the most useful method in general practice, and is carried out in a variety of ways. The ideal backing should answer to the following conditions:—

(*a*) It must be in optical contact with the glass.

(*b*) It must have the same refractive index as the glass, or a close approximation thereto.

(*c*) It must be capable of absorbing the actinic light which reaches it.

(*d*) It should contain nothing at all injurious to the sensitive film.

(*e*) It should not chip or scratch easily, so as to cause dust.

(*f*) It should be convenient in application and quick in drying.

(*g*) It should be easy of removal.

The first three conditions are absolutely essential; the others are highly desirable. I wish to emphasise the point that without the first three conditions the backing is absolutely useless. In the unbacked plate, the glass being in contact with air, internal reflection takes place; this is equally true even if the air be the merest film imprisoned between any badly-applied backing and the glass. If the backing is in absolute or optical contact, and is of the same refractive index as the glass, then we have virtually abolished the back surface of the glass, and any reflection of the rays that takes place must be from the back surface of the film of backing; we have therefore only to see that the backing is absorptive for the actinic rays to destroy this form of halation completely. If we omit any one of these three conditions our labour is in vain.

The varieties of backing in use are many, and of more or less efficiency. I will just mention a few of them, with short comments. Cornu's mixture of oil of cloves, turpentine, and lampblack can be adjusted exactly to the refractive index of the glass, and is optically perfect, but it doe snot dry, and therefore is messy in use and inconvenient for work outside the studio; further, as it is well known that turpentine and such-like substances have fogging propensities if left in proximity with sensitive plates for any length of time, it is objectionable on this score. Collodion, mixed with some non-actinic dye, is fairly good, but not very pleasant to apply, and not too easy to remove. The best plan for removal is to leave the backing alone until development is nearly complete, when a patch can be scratched off with a small palette knife sufficient to judge density; after fixing, the remainder can be removed in the same way, which is now easy, as the collodion is somewhat softened. Washing under the tap, gelatine side upwards, prevents any fragments of the collodion lodging on the film.

Other quick-drying compositions are asphalt in chloroform, removed with benzine and a rag, or shellac varnish and lampblack, removed with washing soda and sponge, or soap dissolved in alcohol, with the addition of some non-actinic dye; the last is easily removed with a damp sponge. Flexible backing pads made of gelatine, glycerine, and lampblack or some other sticky compound, coated upon fabric or tough paper, are sometimes used. With these the great difficulty is to get them into perfect optical contact with the glass. Air bells are easily imprisoned, and as it is impossible to see whether any air bells are enclosed or not, this method cannot be recommended to serious workers. If you will try the experiment of rubbing down one of these pads upon a piece of plain glass, you will see how difficult it is to exclude all the air; the bells will plainly show their presence by the glistening spots seen through the glass plate. The best form of backing for general purposes is caramel, or a mixture of this with other things, usually burnt sienna and a little gum, the solvent being water or methylated spirit and water. The principal component, caramel, has nearly the same refractive index as glass, and is also strongly absorptive of actinic rays. The gum is used to give solidity to the backing. The burnt sienna is used to assist in absorbing the actinic rays, enabling a thinner layer of backing to be used. The spirit is added to facilitate drying, and as much can be used as will not precipitate the dissolved components. Sometimes a little golden syrup is useful to toughen the film when it is inclined to be brittle or dusty. The mixture is easily made with a medium-sized pestle and mortar, without any formula, by testing it on a strip of glass, adding more of such of the components as is seen to be necessary, in small portions at a time, testing between each addition. It is not a long affair to make the mixture, which should coat evenly with a flat hog-hair brush. When dry, the backing should stand rubbing with the finger-tip without soiling it, and should resist a reasonable amount of scratching with the finger-nail. There are other ways of applying the backing, but the brush answers as well as anything. As to the drying, if you have not the proper drying cupboard, any old case or box made light-tight with brown paper and glue will do very well.

The thickness of the layer of backing requires some attention. For all ordinary outdoor work a thinnish coating is sufficient, but for difficult subjects, such as are often met with in the photography of interiors, the coating must be much heavier, so as to provide increased absorptive power for dealing with the greater contrasts; and more care also should be exercised in adjusting the refractive index of the backing to that of the glass. The caramel backing is easily removed before development with a damp sponge; this is better practice than allowing the backing to dissolve off in the developing solution. For orthochromatic plates burnt sienna or any coloured pigment will not do; it is essential to use a fine black pigment, such as lampblack, if the best results are desired.

SOME FALLACIES EXAMINED.

Before we leave the consideration of ways of preventing halation, let us notice one or two fallacious proposals. The first is grinding the back of the glass plate with emery. Where the halation is caused by reflections from the back surface of the glass it is quite evident that while the ground glass modifies the distribution of the halation, it does not reduce its amount at all; the incident rays are simply scattered irregularly, instead of being regularly reflected. Another fallacious proposal is to expose the negative with the glass side towards the lens. This procedure actually aggravates the evil; the reflections inside the glass plate must be precisely the same, as they are quite independent of the position of the plate; but there is the important difference that in this case the rays which are reflected have not had to pass through the substance of the sensitive film at all, and, not having therefore suffered any absorption, are much stronger than when the exposure is made in the usual way. A third plan for preventing halation is by exposing two sensitive plates film to film, using the first merely as a screen, and giving a proportionately longer exposure so as to obtain the negative on the second plate. This is said to reduce halation, but I fail to see why it should do so, and as it is an inconvenient plan for general work, I have not troubled to test it. A piece of black velvet pressed into contact with the plate is absolutely useless as a preventative of halation. It is not in optical contact at all. It may be slightly better than the usual black separating card as an absorbent of the stray light which escapes through the back of the plate, but it has no effect upon the true halation. Of course, where the dead black varnish of the separating division of the dark side is worn off, or is of inferior quality, that part of the rays of light which escapes right through an unbacked plate may be reflected by the card or metal division in sufficient amount to produce the same effects as halation, but this is not true halation; it owes its presence to defective apparatus, and backing the plate with caramel prevents its occurrence at the same time that it prevents the real halation. In forming an opinion as to the relative efficiency of various ways of preventing halation, it is not well to trust too much to ordinary experience. Careful comparative tests under equal conditions should be made repeatedly, and noted for future use; and the experimenter should keep a most vigilant guard against the bias in favour of what we wish to prove which is inherent in human nature.

It is for lack of such care, and because of the want of a proper understanding of the theory, that so many indifferent or worthless suggestions are made. Although I do not wish to offer them to you as perfect models of what experiments should be, an extract from my note-book will give some indication of the way these experiments should be conducted. The object was to compare the amount of reflected halation in an ordinary unbacked plate, a plate backed with caramel and sienna, and an ordinary plate exposed with the glass side towards the lens.

EXPERIMENTAL NOTES.

The brand of the plates used was "Phœnix"; three plates were taken from the same box, but it would have been still better to take a large plate and cut it into three parts. The plates were uniformly coated and opaque, and not prone to halation, and the films were all of sensibly equal thickness. To roughly test the thickness of the films, each edge of each plate was compared with those of the others, by covering up a one-inch hole in a piece of opaque paper with the edges of two plates, and comparing the luminosity of the flame from the red lamp on each half. The subject upon which the exposure was made was an interior with a well-lighted window facing the sky; this was chosen because the necessary length of exposure permitted of accurate timing, and also because it furnished a sufficiently severe test for ordinary work. The intensity of the light was practically uniform, as the exposures were made rapidly one after the other on a day when the light was steady and of a value of 20 seconds as shown by a Watkins' meter used outside the window. The value of the light was tested before and after the exposure of the plates. The time of exposure for each plate was 40 seconds at F.32. The composition of the developer was:—

Pyrogallol	1 grain.
Ammonia	2 minims.
Bromide of ammonium	½ grain.
Water	1 ounce.

The plates were all developed together in the same dish for 6½ minutes. Plate No. 1, which was backed with caramel, sienna, and gum, showed some little halation at the back, which was not surprising, considering the severity of the test and the fact that the coat of backing was not so liberal as it might have been. Plate No. 2, which was exposed in the ordinary way, showed much more halation at the back than No. 1. It would have been considerably worse with a plate of lower quality. Plate No. 3, which was exposed with the glass side towards the lens, showed much more total halation than No. 2. In this case the lateral and reflected halation were upon the same side of the film. These experiments tend to show that backing the plate with caramel, etc., lessens halation, and that exposing the plate glass side towards the lens increases it, which is in agreement with theory. We now pass on to consider how halation is to be cured if it already exists in the negative. One plan is to rub away the surface of the film with the aid of methylated spirits. This is unscientific, and no remedy at all, for the variety of halation which is due to reflection from the back of the glass plate. The image is on the front, and this halation is on the back, so that rubbing the film away simply removes more or less of the image, and does not touch this halation. All that is accomplished is a reduction of the total opacity of the spot at the expense of the quality of the image. The proper course is to strip and reverse the film, when the halation can be rubbed away, leaving the image intact.

Fig 2.

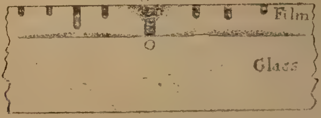


Fig. 2 shows the relation of the details of the image to the halation in the case of a thick film.

Fig. 3.

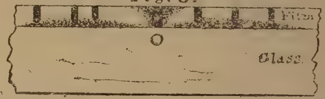


Fig. 3 shows the relations of the details of the image to the halation in the case of a thin film.

CHEMICAL AND PHYSICAL REMEDIES.

The other remedy for reflected halation is to convert the silver image into chloride or bromide; then, after washing and exposing it to light, the image is reconverted into the metallic state by ordinary development; but the action of the developer must be closely watched and stopped before the action reaches the halation at the back, when a bath of hypo will remove the halation while it is in the state of unaltered chloride or bromide of silver. The complete success of these two remedies largely depends upon the thickness of the film; it will be obvious that in a thick film the reflected halation can be completely removed before the finer details of the image are reached, whereas, in a thin film, the image and the halation may overlap or interpenetrate to some extent. Diagrams

Nos. 2 and 3 represent the relation of the image and the halation in a thick and thin film respectively. For that variety of halation, which is due to the lateral spreading of light in the film, there is no real cure. Rubbing the surface with the aid of methylated spirits will remove some of it, but will also reduce the details of the image at the same time; still, it may be better than nothing, particularly if the retouching pencil is used to repair the damage done to the image. In practice, when both varieties of halation exist together, as they usually do, the surface should first be rubbed, but only a little; the retouching pencil should then be used to repair the image; afterwards the film should be reversed and rubbed again upon the other surface to remove the reflected halation. One effect which is frequently confounded with real halation is noticed when the air is misty or dusty; the light which is reflected from the particles in the air impairs the depth of the shadows. This is not always a defect, as the effect of mist has often a pictorial value, and is not desired can be controlled to a considerable extent by the use of yellow screens and colour-sensitive plates. With the other defects which are wrongly attributed to halation, such as the result from dirty lenses or internal reflections in the camera, I do not propose to deal. There is one curious fact which should be mentioned, viz., that it is not an invariable rule that the more translucent the firm the greater the halation. Probably some films, which appear to be very translucent to the eye, may have a great effective actinic opaity, or the actinic radiating power of the particles in the film may be so slow as to more than counterbalance the extra translucency.

ON THE USE OF SENSITIVE PAPER IN X-RAY WORK.

(A Paper read before the Section of Photography and Microscopy of the Franklin Institute.)

The use of so-called "bromide papers" in X-ray work is, of course, not new or original. Rontgen himself, in his early publications on the subject of X-rays, intimated that he had used sensitive photographic paper in the course of his investigations and experiments, and many, if not all, X-ray operators have from time to time made use of this variety of photographic material in their experimental work. The objections that most experimenters have had to contend with in the ordinary commercial brands of paper is the fact that the surface of even the so-called smooth paper is a decided matt. This matt surface gives the resulting picture the appearance of being buried in the textures or pores of the paper, with a consequent loss of much of the necessary detail. The finish or surface of this matt-surface paper is of such a nature that squeegeeing on glass or ferrotype plate does not materially improve the surface or appearance of the picture. Of late years, several manufacturers have put upon the market a glossy variety of developing-paper as a substitute for, or to compete with, the well-known varieties of printing-out papers. This glossy variety of developing-paper has the advantage of keeping the image on the surface, and for this reason is well adapted for the reproduction of more detail in the picture. It should be remembered that the developing papers now on the market vary greatly in speed, or the amount of exposure that is necessary to produce the latent image, and it is obvious that the slow varieties now so extensively used, especially by amateurs, and in which the sensitive silver salt is composed largely, if not entirely, of a chloride, are not at all suited for X-ray work. We must confine ourselves therefore to the older and comparatively rapid bromide papers.

The particular paper that I myself have been most successful with is a comparatively new German brand of bromide paper now being introduced into this country. It is made by the "Neue Photographische Gesellschaft" in Berlin, Germany, and is marketed in different grades of smooth, glossy, and rough; it is coated on what appears to be a very excellent quality of paper stock. The glossy variety is one that is best adapted for X-ray work, on account of the smooth finish and fine texture of its surface. How well it is adapted to this particular purpose may be determined by an inspection of the samples shown here. The question naturally arises, What possible advantages are to be derived from the use of sensitive paper instead of glass plates? The possible advantages are many, and it is my purpose now to call attention to some of the more evident points of vantage as they have occurred to us while experimenting with the various brands of bromide paper available at the present time. First, the matter of price: in this the use of paper would result in a saving of from 40 to 60 per cent. of the cost of dry plates. Other things being equal, this one feature alone would be of sufficient importance to insure the very wide use of a sensitive paper that could be relied on to give satisfactory results under all conditions and at all times.

Another advantage is the saving in possible breakage. Every X-ray operator has had experience in this line. The breaking of a glass plate usually occurs towards the end of an exposure, and always in a case that has necessitated a considerable amount of care in the preparing for and patience in making the exposure. The ominous click that accompanies the accident not only means the loss of a rather expensive plate, but also a waste of the time and energy that has been expended in preparing for and in making the exposure. Nothing of this kind is at all likely to occur with paper, so that the exercise of ordinary precaution would insure us against any possible danger of wasted exposures. The facility with which the resulting pictures may be stored will, of course, appeal to all, as the difference in bulk and weight is self-evident. One feature of considerable importance in this connection is the fact that the name of the patient and all the necessary data relating to the case or the making of the exposure may be written on the back of the exposed sheet before development, in this way obviating any possible chance of making a mistake by confusing two or more of the resulting pictures. Many physicians who are not familiar with, nor in the habit of looking at, photographic negatives, cannot see detail in a transparent plate, and, consequently, prefer to have a print. This opens up another possible field for sensitive paper. Not only would the use of this paper obviate the necessity of making positive prints, but we may, if we choose, utilise the paper in combination with glass plates for the same purpose. By exposing a piece of paper and a glass plate at the same time, and developing them in the same solutions, we not only make the paper print and the glass negative at the same time, but we also, in addition to this, have a more or less valuable means of control; for by comparing our results a possible flaw in the plate could not possibly be mistaken for a pathological condition of the part of the patient radiographed.

If for any reason we desire to have two or more prints of the same subject, we can readily obtain them by exposing the required number of sheets of paper at the same time. The paper itself offers little or no resistance to the rays, so that we can expose a dozen sheets as readily as we could one. Probably the greatest advantage is the rapidity with which we can obtain the desired information. Those of you who have had any experience in this line well know how anxious the doctor usually is to see the result of the exposure; you also know that a plate in the process of development is not always the most reliable source of information, so that, under ordinary circumstances, we are obliged to wait until the plate is sufficiently fixed to be transparent. This extra wait for the fixing bath can be avoided by using paper, as, after proper development and a thorough rinsing in water, the resulting picture may be examined in broad daylight without any appreciable damage by fog or other change of the residual silver salts. The necessary fixing in hypo may be done later. These are but a few of the possible points of superiority that have presented themselves to us while experimenting, or in the regular routine use of the X-rays. There are, of course, drawbacks and defects in paper at the present time. One of them is the comparative slowness of the emulsions used on ordinary bromide papers. This, to some extent, has been overcome by this same German company, in what they call their negative paper, the emulsion on which is much richer and, consequently, more rapid than that used on their regular grades of paper. This negative paper is very thin, and is intended to replace celluloid films, and also the various kinds of stripping films that are at present being reintroduced and used quite extensively, especially in Germany. This thinness or transparency of the paper would also tend to do away with another rather serious objection to heavy bromide paper—the tendency for an image, especially of the heavier portions of the body, to veil over or fog; a perfectly transparent paper would give us all the possible advantages of a glass plate in this respect. There remains but one more serious question, and that is the keeping-quality of paper coated with a very sensitive emulsion of silver salts; and, while this may possibly be a serious, or, rather, a difficult problem, there appears to be no positive reason why manufacturers cannot obtain a paper that will not affect the sensitive salts in the emulsion.

In addition to its use as a substitute for glass plates in taking the impression direct, glossy bromide paper can, of course, be used to advantage for reproduction, or the making positive prints from X-ray negatives. For this purpose the German brand of paper also has some points of superiority; for, in addition to its being a very rapid paper, so far as the time necessary for exposure is concerned, it has the added advantage of being a slow, or, rather, steady developer, so that we have considerable latitude in this step of the process, and can modify the resulting picture to a considerable extent by either accelerating or retarding the same in the course of its development. Those of you who are in touch with or consult German photographic or X-ray journals will probably recall the really beautiful reproductions on bromide paper that these journals occasionally contain. This so-called method of "light-printing," while it appears to have originated in this country, does not seem to have been developed or followed to any considerable extent. In Germany, on the other hand, it has evidently been developed into a distinct branch of the printer's, or, rather, the photographer's art. The printing and developing of these pictures are done automatically, by means of specially constructed machines, and it would appear that there was a possibility of developing this same method of photographic printing in this country so as to make it available for illustrating books and periodicals in cases where the presentation of detail is considered of sufficient importance to assume a possible slight increase in cost.

M. I. WILBERT.

SOME APPLICATIONS OF LIGHT FILTERS IN LANDSCAPE PHOTOGRAPHY.

(A Paper read before the Photographic Club.)

It is a matter of some surprise, having regard to the length of time orthochromatic plates have been procurable, that the bulk of photographers still remain either indifferent to their advantages or unable to grasp the principles associated with their use. A large number of photographers take it for granted that an orthochromatic plate cannot be used except in conjunction with a light-filter, and that a light-filter requires an enormous increase of exposure, making the use of these plates out of the question for anything like practical work. Yet another section of photographers disallow that the orthochromatic plate has any advantage over the ordinary for landscape work. In the tenth edition of Sir W. Abney's "Instruction in Photography," published a few months ago, it is somewhat astonishing to me to read that "Orthochromatic plates are principally useful for photographing pictures, and are not of much advantage for landscape work."

In the present paper I would like, with your permission, to review the advantages of the orthochromatic plate, plus its commensal—the light-filter, from a landscape photographer's point of view. And I must ask your consideration, if I appear to ignore somewhat the title of my paper, for it is advantageous to compare the ordinary plate with the orthochromatic at many points, and also the orthochromatic without a light-filter against a similar plate with one. At the outset I would disclaim any exactitude in orthochromatic processes; to the workers in trichromatic photography my methods and appliances must seem crude and elementary. For the class of work I have in view, however, they are sufficiently exact, and my aim is to encourage workers to take up colour-sensitive plates and filters by keeping accessories and manipulations as simple as possible rather than deter them by suggesting difficulties and refinements which are uncalled for.

The selection of filters for trichromatic photography is a care requiring very considerable knowledge and research, but in landscape photography a comparatively rough method will suffice. It is, of course, undesirable to eliminate any portion of the visible spectrum when choosing a filter for landscape work; what is required is a medium which will reduce the activity in the violet region. For a long time I worked entirely with glass media, but the quality of absorption in any glass I examined left so much to be desired that I found it more satisfactory to prepare my own filters by using one of the various dyes suggested for this purpose. The two I pass round satisfy my demands very effectually. Of the two, the ammonium picrate filter is the one generally used; it subdues the activity in the violet sufficiently to be useful, yet does not disturb the tone values. You will notice that the filter is graduated; in use the denser portion is placed so that it intercepts those rays falling upon the plate from the sky and extreme distance. The amber filter is a most valuable item in the landscape outfit, but it requires considerable care in its application. Its fault, from a photographic point of view, is that it absorbs too effectually the blue rays, hence its use completely upsets the tone values. However, as I shall endeavour to show you later on, there are occasions in landscape practice when, if the photographer is willing to compromise a little, he will obtain results with it which are impossible by any other method. If you

ORANGE CAMERA CLUB,

examine the two filters with the spectroscope you will notice that the ammonium-picrate absorbs strongly in the violet, while the amber filter continues further into the indigo.

Although the title of my paper does not justify me in instituting any comparisons between the ordinary plate and the orthochromatic, it will, perhaps, be interesting if I show you comparative results in order that you may decide for yourselves how much advantage rests with the orthochromatic plate. The slide No. 1 is from a negative on an ordinary plate, No. 2 being the same subject from an orthochromatic plate, used in conjunction with the picrate screen. You will notice that on the ordinary plate the distant mountains and well-defined clouds do not appear at all, though they are perfectly rendered on the orthochromatic. In many instances I have failed to detect any advantage of the orthochromatic over the ordinary plate when the orthochromatic was used without a filter. It must not be thought, however, that because in some subjects the orthochromatic fails to register an improved rendering when used without the filter no advantage accrues from the adoption of the orthochromatic plate; in very many landscape subjects a distinctly better result is obtained on the orthochromatic plate even when used without the filter. The case for the orthochromatic plate is very well put by saying that there is no disadvantage attending its use, while the advantages over the ordinary plate are undeniable. I will show you three slides of the same subject, one from an ordinary plate, another from an orthochromatic plate minus the filter, and a third from an orthochromatic with a filter. All three were taken within half a minute of each other to obtain constant conditions. There is, as you will observe, practically no difference between the ordinary plate and the orthochromatic without the filter, but the difference is most marked when the filter is used. One other example I give you of the difference between an ordinary and orthochromatic plate. The subject is a bit of common, with fleecy clouds upon a background of pale blue sky. You will, I think, agree with me that the ordinary plate has completely failed to render this with anything like the truth of the orthochromatic when conjoined with a suitable filter.

Passing now to the legitimate scope of my paper, I will instance several conditions familiar to the landscape worker that may be considerably improved by the use of an orthochromatic plate and filter. In mountain regions, or when any considerable extent of country has to be included in a view, haze is one of the most serious drawbacks to successful photography. The distance is sure to be quite obliterated, unless some means is available of reducing the activity of the blue rays. This means we have in the filter: interpose the ammonium-picrate filter between your plate and the subject, and you will get the distance clear and sharp; at the same time procuring full detail in the foreground. It has been said that this haze is one of the chief charms of an English landscape, which it is undesirable to eliminate by the use of orthochromatic plates and filters. But anyone who has tried to reproduce quantitatively in a negative the haze of a landscape knows how impossible is the task; the distance *will* solarise out of all recognition if the foreground is to receive an adequate exposure. But by the use of a filter of suitable depth the activity of the blue rays will be reduced just enough to give a fair rendering in the negative of the amount of haze in the original. At times the haze is so great that even visually the distance is almost obliterated. Light-coloured filters are useless when such is the case; if the photographer must work under such conditions the deep amber filter will be his best friend. In the next slides I have endeavoured to illustrate the value of this filter for dense haze. One of the slides is from a negative with the filter, which shows a range of mountains about twenty miles away just perceptibly outlined, whilst in the negative taken without the filter these mountains have absolutely disappeared, and the coast line but two miles away is seriously degraded. This was a very severe test of the capacity of a deep-coloured filter to remove haze; the distant range of mountains, even to the eye, was but barely distinguishable owing to the north-east wind that had been prevalent for some days.

When using these deep-coloured filters care has to be taken against under-exposing the plate, or the result shown in the next slide will be the consequence. You will notice that although the clouds and distant mountains are nicely rendered, the foreground is unsatisfactory from over-correction. The water is too dark, while the grass in the immediate foreground is quite white. This false rendering of tones is due to over-correction in the filter, greatly aggravated in this instance by under-exposure. Full exposure, of course, minimises the evil of over-correction when using these deep filters, as you will see from the next slide, which is of practically the same subject and taken under the same conditions, but with nearly double the exposure of the former. It is entirely a matter of compromise when using these deep filters, and I consider the slight amount of over-correction is more than counter-balanced by the superior general effect. When the foreground is some considerable distance from the camera, and does not consist of light greens, the over-correction is barely noticeable, a point that will be apparent from a consideration of the next slide. Another picture very well illustrates both the advantages and the disadvantages of the deep filter. You will observe in it a large newly-mown field in the middle distance which has been made to look like a field of snow by the over-correction of the filter; the remainder of the landscape is very well rendered. It was an error of judgment to use such a deep-coloured filter on this subject; had one similar to the ammonium-picrate been used everything would have been correct in tone-value.

There is one application of the deep amber filter I would like to illustrate, although it may be more interesting than practical. If such a filter is used when the light is very poor its tendency to over-correction becomes really useful, as the greens in the landscape are brightened up in a wonderful manner, and any haze that may be obscuring the distance is effectually removed. The picture shown is from a negative taken as a test. It was obtained late in the afternoon of a dull, wet day; a fine drizzle was falling during the exposure, and the quality of light may be estimated by the fact that it had about forty seconds' exposure with a fairly-rapid orthochromatic plate. You will allow, I think, that there is a fair amount of sparkle in the result; certainly an ordinary plate under the same conditions, or even an orthochromatic without a filter, would have failed altogether.

For mountain work these deep filters are invaluable, and as there is rarely much foliage in this class of work, the over-correction is quite negligible. Haze is so prevalent in the mountain districts of England that unless it is modified by the use of filters there is little chance of rendering the contour lines of distant mountains. The next slide shown is a view of the central Snowdon group from a distance of about fifteen miles. You will observe that, in spite of the distance, no loss of modelling occurs in the mountain slopes.

If the photographer has work to do in towns and cities he may, by the aid of filters, wage a fairly successful war against the smoke that generally makes photography so difficult in such places. The drawback to their use is, of course, the prolonged exposure, though even this may be turned to advantage at times. If, for instance, it is desired to photograph some building without having inexplicable patches on the negative of what in the subject were passers-by, a filter and small stop by prolonging the exposure will prevent their transitory movements impressing the plate.

It will be readily understood from what has previously been said that when dealing with foliage subjects the photographer has, in the filter, a means of improving the quality of his negatives not open to the user of ordinary plates. Even without the filter the orthochromatic is the superior of the ordinary plate for this class of work; with the filter the advantages in more than one direction are incontestable. Where various shades of green are present it is possible to get their tone values better translated with a filter than by any other means. The slide before you represents very well the rendering of an orthochromatic plate for foliage subjects. Care has to be exercised when using filters on such subjects that they are not too deep, otherwise the over-correction is worse than its opposite, which obtains with the ordinary plate.

It has always appeared to me that negatives taken with a good filter reproduce the effect of sunlight better than is possible by any other means. When I look at the next view it reproduces in my mind the exact impression I derived from the original subject. There is a truthful rendering about subjects taken with a filter that is absent from those where it is not used. In this subject the birches stood out against a background of dark clouds, with a brilliant white cloud towards the horizon, while a flood of sunlight bathed the middle distance. Had this negative been on an ordinary plate it would have failed to suggest any of these conditions to the mind. I have here slides from comparative negatives done for the purpose of satisfying myself that a better rendering of sunlight can be got with a filter. These were taken late in the evening, with the sun low down. You will see that in the negative without the filter, the rendering of sunlight is practically nil, and one gets no idea conveyed to the mind of the broad masses of shadow that filled the foreground.

I think that a good deal of the neglect the landscape photographer has shown orthochromatic photography with filters is due to the fact that he has grown so accustomed to the translation of tones by the ordinary plate that he cannot bring himself to accept the more truthful rendering of the orthochromatic. It is, I admit, rather revolutionary to find a group of trees represented by leaves and stems in place of the dark patch usually made to do duty for it.

To conclude, gentlemen, I have tried to show some of the advantages to be had from the use of orthochromatic plates and filters. In my own work I have used them exclusively for the last thirteen years, and I have satisfied myself by repeated comparative tests that the colour-sensitive plate and light-filter is of the greatest value to the landscape photographer. It is quite true that not every subject is the better for being taken on an orthochromatic plate; unless a filter is used the difference in very many subjects between an ordinary and orthochromatic plate is barely discernible, but once the filter is applied the case is quite different. Even halation gives way in a great measure before the use of the filter. Finally, let me give intending users a word of advice—don't carry fluid filters into the field; they are sure to leak sooner or later, and stained films answer very satisfactorily all average requirements.

GEORGE T. HARRIS, F.R.P.S.

THE USE OF THE STEREOSCOPE IN MEDICINE.

Abstract of a Paper read before the New York State Medical Society, October, 1901, and reprinted from "The Stereoscopic Photograph" for December.)

The most important use of the stereoscope in the practice of medicine is that in connection with squint or "cross-eye." In such eyes the faculty of single binocular vision is in abeyance, due to the fact that the eyes are not used together, and also to weak or poor vision which usually obtains in the squinting eye. Even in cases where there is not a manifest squint, but only weak muscles, and in cases where the vision is much weaker in one eye than in the other, from whatever cause—an error of refraction, opacities of the media, etc.—where binocular vision is difficult, the stereoscope is of the greatest help in strengthening such eyes and maintaining single vision with the two eyes at once. Again, in cases of squint where the eyes have been operated upon but not quite straightened, the stereoscope is of much service in completing the cure and developing true binocular vision. Although the stereoscope was invented in 1833 by Wheatstone, and its use explained more or less fully by him, Brewster, Carpenter, and others, it was not taken in a serious way at all by the public, who considered it simply as a toy for amusement. The medical profession held the instrument in about the same esteem as did the public at large. The laity, or many of them at least, got the mistaken idea that the stereoscope was often injurious to the eyes; especially was this so if the eyes became tired after using the instrument for a little while. They did not stop to consider that the fault might be in their own eyes, due to a lack of proper adjustment of the focus in one or both eyes, or to maladjustment in the movement of the eyes, or to faulty direction of them. It was not until Javal, of Paris, began to investigate the causes and cure of squint, in 1871, and brought the stereoscope to his aid in the correction of this deformity and the restoration of true binocular single vision in these cases, that the stereoscope was appreciated for its true worth in medicine. Von Grafe, also, was one of the earliest investigators to appreciate the value of the stereoscope in such cases, and he regarded stereoscopic vision as the crucial test in a successful cure of squint. In squint but one eye is used at a time, the other being turned inward towards the nose, convergent, or outward, towards the temple, divergent, respectively, as the case may be. At times the eyes may also deviate in a vertical direction. Inasmuch as the condition in squint is that one eye only is brought into use at a time, binocular vision is, of course, impossible, since binocular vision necessarily means the use of both eyes at once. Furthermore, in almost every case of squint there is some error of refraction in one or both eyes, with the error usually more pronounced in the squinting eye. In convergent squint we have, as a rule, far sight or hypermetropia present, with astigmatism often also as a complication. In divergent squint, where the eyes turn towards the temple, near-sightedness or myopia is usually present, and astigmatism also in addition. It is altogether essential, therefore, in the treatment of squint, first to fit the patient with the correct glasses. In so doing the focus in each eye is made more nearly equal, the images on each retina made brighter and more nearly equal, and the strain taken off of the focusing muscle.

Three steps are necessary in bringing about single binocular vision: first, a *simultaneous* perception of the images of the object in the two eyes; second, *fusion* of these two images into one; third, perception of *relief*, that is, true *form perception*. For all three purposes the stereoscope is of the greatest service. Special stereoscopes have been made for training the eyes afflicted with squint; also special pictures or views made to be used in such cases. Javal, George J. Bull, Prestly Smith, R. H. Derby, C. Worth, and several others have invented special stereoscopes. Some of these stereoscopes are so constructed that the distance between the eye-pieces can be easily changed so as to fit the eyes of any observer; also in some of them the eye-pieces can be set to suit the varying degrees of squint; and in some of them the illumination on the two sides can be varied. Javal and Bull, of Paris, have invented a stereoscope which has as many as five movements, while the Derby stereoscope is so arranged that the half-views on the card, by a simple screw arrangement, can be moved both in a lateral and vertical direction. In regard to the distance between the eye-pieces, it is essential that it should correspond closely with the distance between the centre of the pupils of the eyes. If the eye-pieces of the stereoscope are wider apart than the eyes, the rays of light pass nearer the edges of the refracting prisms and are more strongly refracted than when passing through the centre of them, with the result that the images of the pictures on the card are too widely displaced, so that the eyes cannot bring them back to their place of union and fuse them into one, half-way between the two pictures on the slide. Or, if the eyes do succeed in fusing the pictures, it is by a great strain on the convergence, and this is painful and, besides, injurious to the eyes. Again, if the eye-pieces of the stereoscope are closer together than the eyes, the two pictures are not displaced or separated widely enough; and, again, the fusion of the two pictures into one at their proper place of union, half-way between the two pictures on the card, is made difficult or impossible. The average distance between the pupilary centres in the adult is 2¼in., and this should be the distance between the eye-pieces of the stereoscope where they are stationary. For ordinary stereoscopic views this is accurate enough, but for special practice a chargeable distance between the eye-pieces is desirable. The object in having the stereoscope so arranged that the illumination of the two sides can be varied is to make the images in the two eyes more nearly equal in brightness and definition, when the eyes themselves are unequal in visual perception. For instance, if one eye has poor vision, and consequently dim images, while the other eye has good vision and bright images, it is difficult to fuse these two images of different intensity into one and have single vision, whereas, if by dimming the illumination in front of the better eye until its image is more nearly equal to that in the poor one, it is much easier to fuse these images, which are more nearly alike.

Concerning the change in the angle of the eye-piece, it is desirable to have such an arrangement where the eye squints and the images for the two eyes are thrown wide apart and cannot be fused unaided. However, if the angle of the eye-piece can be changed so as to bring the images of the object on the macula of each eye at once, often the images are fused as one, and afterwards the eye-pieces can be gradually turned back to a correct position, as for eyes that are straight, encouraging the eyes to turn with them. With much practice single binocular vision is greatly stimulated in this way. Sometimes, instead of having the eye-pieces change their direction, the card with the double picture on it is divided vertically in the middle, and so arranged that the two pictures can be approached nearer to and further apart than for normal eyes, and in this way fusion of the two images can be effected. As a rule, the first card we place in front of the eyes in squint cases is one with simply a round black dot on each side of the card. The card is a sliding one, or the angle of the eye-piece of the stereoscope must be one that can be changed, so that the dot can be placed in the visual line of each eye. If the patient succeeds in fusing these simple round dots, especially after varying the distance between them slightly, we then substitute more varied figures, as truncated cones or pyramids, and let him fuse these. To be sure that the patient is really fusing the images of the two eyes, and not suppressing the image in one eye, it is necessary to add small distinguishing marks to the right and left picture respectively. If the patient sees the object as one, with both distinguishing marks present, we know he is fusing the images; but if with only one of the distinguishing marks present, then we know he has suppressed one of the images.

Many people use but one eye at a time, and are totally unaware of the fact, thinking that they are using both eyes together. They see, but do not see perfectly. A striking example of this occurred in my practice this past winter. A young minister, thirty years of age, had a cross-eye which was operated on when he was eight years of age and almost straightened, but not quite so. The eye was so nearly straightened that no one could ordinarily detect the cast in it; and he himself thought he was using his eyes together until I put the stereoscope before them, when he discovered he saw double. After one week's practice with the stereoscope he saw objects singly, perceiving for the first time the correct form of objects in their third dimension distinctly. It is unnecessary to say he was highly gratified with the result. While this is a striking case of its kind, it is not an uncommon one. Another use for the stereoscope in medicine is for the illustration of pathological specimens. By means of the stereoscope these specimens can be made to stand out in relief, and in this way a much better idea of their nature and true form can be obtained. An instrument called the verascope is used for this purpose also, which is, in fact, a stereoscope in which the views or specimens are seen by transmitted light rather than by reflected light, as in the usual stereoscope. In prescribing stereoscopic exercises in cases of squint, care should be taken that the patient gets a suitable stereoscope. The special stereoscope in which the distance between the eye-pieces can be changed and the angle varied to suit different degrees of squint are the best. Unfortunately, because of their high price, they are many times beyond the reach of patients who need them most. Where the special stereoscope cannot be had, the ordinary stereoscope with the sliding views, in which the distance between the two pictures on the stereoscopic view can be varied, is the next best thing. For ordinary stereoscopic exercises, in cases where there is no actual squint, the ordinary stereoscope, in which both the specials views and the ordinary views can be used, answers all purposes.

In conclusion, it is important to notice that, as medical practitioners, we have, in the stereoscope and its accompanying views, most valuable auxiliaries. If we were called upon to prescribe for our patients an optical exercise which was irksome or mechanical merely, or even one that was devoid of any special interest to them, they would not be inclined to use it with the persistency and faithfulness the conditions might require, and hence we might despair of effecting a cure, at least, in a large number of instances. But the case is far different, since in the stereoscope and views we have one of the most fascinating and instructive methods conceivable, a method of representation that is marvellously realistic, since it shows objects life-size and in three dimensions. Whatever the patient's intellectual bent, be it history, art, travel, or science, we have here a means of gratifying it, since special sets of stereoscopic photographs have been prepared representing all the leading countries of the world, and an interesting guide-book accompanies each set, which furnishes a vast deal of valuable information in regard to the views. To be asked to view such remarkable representations of famous persons and places cannot fail to be a source of pleasure as well as of profit to our patients. You may not be aware of the fact that the stereoscope is used to teach history, physical geography, and the sciences. For instance, classes in history are given certain subjects, city or country, to read up on, and at the same time stereoscopic views representing historical places, as temples, palaces, courts, cities, etc., of such countries, and of distinguished persons who have helped to make its history, together with different types of its population and its animal life, are placed before them. So, in the study of physical geography, the different formations of the land's surface and strata can be shown better by means of stereoscopic views than in any other way, except by actual visits and direct inspection. The stereoscope is also used to advantage in the study of natural history, in architecture, in engineering, and in sculpture, specimen stereoscopic views being given to the students to study in connection with the reading matter. In this way the class-room work is rendered wonderfully interesting, and the subject becomes a live one, a present reality. The Government uses stereoscopic photographs for purposes of instruction in the military academy at West Point. What is being done so largely elsewhere should be utilised even more generally than heretofore in the medical colleges of our land, for there is no better way of giving the students a knowledge of anatomical and pathological conditions, apart from the realities themselves, than by the realistic representations which are afforded us in the use of the stereograph. A library of medical stereographs should be in every medical college. I have simply attempted to give an outline of a subject which in itself is so vast and inexhaustible that to do more would require a large volume. If I have intimated, even in a very vague and general way, the boundless possibilities that are wrapped up in the stereoscope and stereograph, and especially if I have brought to your notice, as physicians, a method that has proved invaluable in my own practice, and shall in any measure be instrumental in bringing you to utilise the same, the purpose of this paper shall have been accomplished. A. Edward Davis, A.M., M.D.

FACTORIAL DEVELOPMENT.

(A Paper read before the Oxford Camera Club.)

It was in 1894 that Mr. Watkins first brought out his system of factorial development, and it is worthy of note that previous to that date he had regularly practised tentative development with pyro-ammonia. I do not propose to go over again all the history of the subject, or to describe in detail the numerous experiments which induced Mr. Watkins to formulate his law as to factorial development. The experiments have now been before the public for over seven years, and I have not yet heard of any scientific observer who has brought forward any facts sufficient to throw doubt on the accuracy of either the experiments or the deductions made therefrom. On the other hand, other experimental work has been done that has corroborated that of Mr. Watkins in a remarkable degree. The deductions Mr. Watkins arrived at may be briefly stated as follows: That all developing agents will give equal density if allowed to act for a sufficient time; that bromide holds back the lower tones temporarily, but, as shown by Messrs. Hurter and Driffield, it must be added before development is begun, and even then with lengthy development the tones come back to the original ratio; a difference in the quantity of alkali only alters the speed of development and not the gradations. Other things being equal, the longer a plate is developed, the greater the contrasts and vice versâ. Finally, Mr. Watkins deduced the important law, "That any change of temperature (within limits) or of amount of alkali (or of strength of developer with most developers) which lessened or increased the time required for a certain amount of contrast (or density) also altered the time of appearance of the image in exactly the same ratio." Or, in other words, that using the same developer the ratio between the time of the first appearance of the image and the total time of development was always the same for the same density. To make this plain let us take an example. Suppose we expose two plates on the same subject for the same length of time. We take one and pour on it a developer at 65° F., and after it has been covered for one minute, we note the first sign of an image; then supposing the factor of the developer is six, we leave it in the solution for six minutes. Now take the other plate and develop it with the same developer at a temperature of 45° F. In this case nothing will probably be seen of the image for two minutes, but again multiply by six and leave in for twelve minutes. It will then be found that the two negatives are identical, though one was developed for a total time of six minutes and the other for twelve.

Now, it is a curious fact that with all the developers on the market, except pyro and amidol, the amount of the developing agent present in the developer makes no difference to the developing factor, but with pyro a great difference results within certain limits, so that with this developer the same factor can be always used, and the density varied by diluting the developer. Developers generally may be divided into two classes: (1) Those that give detail readily and density only after a long period, such as metol, rodinal, and weak pyro; (2) those that give detail slowly but density very quickly, such as hydroquinone, strong pyro, and adurol. The first class have large factors, and the second very small factors. An intermediate developer is probably the best for ordinary work, while the mixing of a developer of each class has advantages, the combined developer having a factor in proportion to the amounts of the different developing agents used. I would, however, at this point like to warn workers that Watkins' factor law does not appear to be correct for some of the mixed developers; that is to say, that a difference in temperature will alter the scale of gradation. In a photographic journal a short while ago a writer singing himself F. C. L. gave the result of a series of experiments relating to the effect of temperature on the action of different developing agents. He found that a drop of 20° F. from a summer temperature had a very different effect on different agents.

In Pyro the image was twice as long appearing.
Ortol the image was five times as long appearing.
Quinol the image was four times as long appearing.
Metol-quinol the image was three times as long appearing.

In the first three the gradation of the negative was practically the same in hot and cold when the same factor was used, thus corroborating Mr. Watkins' experiments; but in metol-quinol the gradation was much less steep in the cold than the warm. This, however, is only natural if we consider for a moment that quinol, the density-giving agent in this combination, works four times as long with a drop of 20°, while the period previous to the first appearance of the image is only three times as long in the combined developer. It is obvious, therefore, that to use the factor method with this developer it is necessary to always develop at approximately the same temperature. The factors of some of the most used developers are given by Mr. Watkins as follows:—

Pyro-soda.	1 grain pyro, ¼ grain bromide	9
,, ,,	2 grains pyro, ½ grain bromide	5
,, ,,	3 grains pyro, ¾ grain bromide	4½
,, ,,	4 grains pyro, 1 grain bromide	4
,, ,,	8 grains pyro, 2 grains bromide	3¼
,, ,,	Ilford Maximum pyro	4½
,, ,,	Ilford Minimum pyro	5½
Hydroquinone		5
Metol		28
Rodinal		40
Ortol		10

It would be well if, before adapting this method, photographers would try and comprehend what it all means, and not use the law in a blind way, expecting it to automatically turn out a perfect negative from every exposure. Of course, if everything had the same range of tones, then with the help of an actinometer it might be possible to produce good negatives with automatic precision; but, fortunately or unfortunately, subjects vary very much in that respect, and in the cases of very long range or very short, the results have to be to a certain extent falsified to obtain satisfactory and pictorial results. For instance, in a dark interior with clear glass windows the exposure should be very full, and the factor used should be smaller than that generally adopted. Again, in a distant landscape where the range of tones is very short, a brief exposure and a longer factor will produce the best results. What should be borne in mind is that length of development regulates contrast, and that the factorial system enables the worker to regulate length of development. Each man should find out by two or three experiments what factor best suits his developer and his favourite printing process in average work, and then raise the factor or lower it according to whether he requires his finished print to have harder or softer contrasts than the original subject. A great point about the system is that slight errors in exposure have practically no effect on the resulting print; all that happens is that the negative takes a long or short time to print, according to whether the exposure is too long or too short. I have two sets of prints taken from twelve negatives. The first six are of an interior subject, and under identical conditions were exposed for 3, 6, 9, 12, 15, and 30 seconds respectively. The other six were exposed on an exterior subject, again under identical conditions, for 2, 4, 8, 16, 32, and 64 seconds. The differences in the results are very slight, and in five of the prints of the outdoor subject practically negligible, notwithstanding that the original negatives were on special rapid plates (Imperial), and that in the first series the proper exposure was about 30 seconds, and in the second series about 4 seconds. It is worthy of note that the difference in the exposures altered materially the time at first appearance of the image. In the interior six the image appeared in 120, 115, 110, 100, and 90 seconds; in the exterior six it appeared in 100, 90, 75, 70, 65, and 55 seconds. It is evident, therefore, that the time of first appearance of the image depends on the length of exposure as well as the composition of the developer, the temperature, and the intensity of the light at the time of exposure. Developers that can be used over and over again are of doubtful value under this method after repeated use, as increase of bromide obtained from the plates during development may gradually alter the contrasts, especially with those that give density quickly. The best method is to use a pyro-soda developer so constituted that it will give good results with a factor of 6. This is what Mr. Watkins styles his sextuple method, and it has two great advantages. In the first place, it does away with any mental arithmetic, for the number of seconds that elapse before the image appears only have to be divided by ten to give the minutes that total development will last. For instance, if the image appears in 40 seconds, total development will occupy 4 minutes; if it appears in 55 seconds, the total time will be 5·5 minutes, or 5½ minutes. The second advantage is that pyro being the developing agent, the contrast of the negatives can be altered by the amount of the dilution of the developer without changing the factor.

In my own work, however, I must own that I prefer altering my factor to changing the strength of the developer, but that is purely a matter of personal convenience. I can say most truly that ever since I have adopted factorial development, some two years ago, I have obtained from my exposures a far higher percentage of good printable negatives than I ever got before.

I sincerely hope that any members who have not yet done so will give the factorial method a trial, using the factor law in an intelligent way with a view to getting the results they require, and not as a sort of automatic machine, which has only got to be set in motion to produce a perfect negative every time. The process is one that is specially useful to the amateur. Pyro can be used without any fear of getting the fingers stained, for the plate need never be removed from the dish till development is complete. There is no need to look through the plate, therefore it does not matter if the strength of the dark-room light is not always the same. But one of the great advantages of all is that, even if no developing has been done for a considerable period, good negatives can be got immediately on resuming work, and there is no fear of spoiling half a dozen plates before one has got back the knack of judging density. Before concluding I should like to impress on you one important point, and that is that the time of first appearance should be estimated from the first sign of that part of the negative that the photographer wishes to appear as practically white paper in the final print.

CLAUDE RIPPON, M.A.

CONTRIBUTIONS TO OUR KNOWLEDGE OF COLOUR IN PHOTOMICROGRAPHY.

(By F. L. RICHARDSON. Journal of the Boston Society of Medical Sciences, 5: 460-464.)

ONE of the most perplexing and as yet unsolved problems of photomicrography is that of colour values, *i.e.*, how to reproduce natural colours by means of the sensitive plate. Of the plates now in use, the orthochromatic approaches most nearly the ideal colour plate; yet this is not perfectly satisfactory, as it does not give sufficient contrast.

The investigations which form the basis of this article were undertaken to determine the relative merit of various photographic plates. The apparatus, as illustrated in Fig. 1, consists of a direct vision spectroscope so mounted in the front board of an ordinary camera (with lenses removed) that the spectrum, when projected on the plate, will come in the centre horizontally and at the top of the plate. The back of the camera is constructed in such manner as to allow of its being moved in the vertical plane, thus making it possible for one to make four exposures on the same plate, and by so doing to make an accurate comparison between them.

The plates examined may be grouped according to their degree of perfection as follows:—

Group I.—Characterised by a very high degree of sensitiveness a little above line D, falling off abruptly on either end, and only slightly sensitive to the greens and blues.

Group II.—Characterised by two distinct maxima—one a little above the D line, and the other in the blue-green. Between these two maxima the sensitiveness falls very considerably.

Group III.—Characterised by having its maximum sensitiveness in the blue (as with ordinary plates), with lesser bands of sensitiveness extending below the D line.

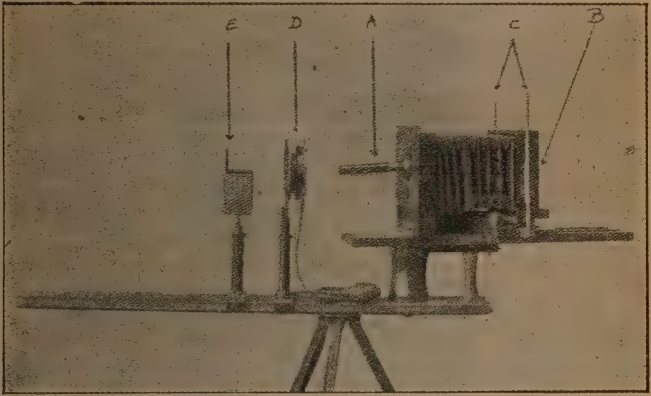


FIG. 1.

Apparatus for making spectrographs.—A, Spectroscope. B, Back of camera, carrying screen and plateholder. C, Supports upon which the back (B) may be moved, D Shutter. E, Colour screen in colour screen holder.

Group IV.—Characterised by bands of sensitiveness extending below line D, with greatest intensity in the yellow-green, and falling off at the violet end before H_2.

Group V.—This group most nearly approaches perfection. It is characterised by a sensitive band well below line D, and somewhat below the red end of Groups III. and IV. This plate gives an almost uniform degree of sensitiveness with a maximum intensity in the green.

If sensitiveness to the spectrum were the only feature to be considered in the selection of a plate for photo-micrographic work, a plate from Group V. would be chosen, but the general working of the plate as well as the keeping qualities are factors that must be considered. For practical work and keeping qualities the author found the Cadett & Neall Special Slow Spectrum Plate of Group IV. most satisfactory, and used it in the preparation of the spectrographs illustrated in Fig. 3.

The perfect photo-micrographic plate would give equal photographic intensity to all the colours of the visual spectrum, but since this degree of excellence has not been attained, the value of a given plate may be enhanced by the use of colour screens, or ray filters, which serve to increase or decrease the photographic intensity of a colour. The following are the laws upon which the use of colour screens is based:—

First.—To increase the photographic intensity of a colour, a screen of complementary colour should be used.

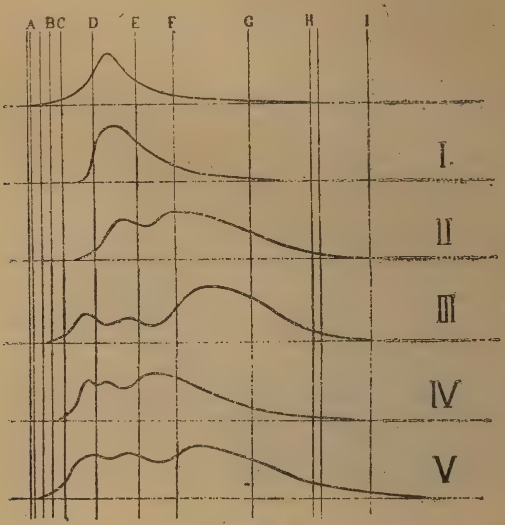


Fig. 2.

Explanation to Figure.—The upper curve shows the visual intensity of the spectrum (from Fraunhofer). Curves I.-V. represent the photographic intensity of the spectrum taken on plates from group of corresponding number. GROUP I.—Cramly isochromatic (slow). GROUP II.—Standard orthochromatic (slow); Forbes orthochromatic (slow); Carbutt orthochromatic (slow); Otto Perutz. GROUP III.—Loveld colour-differentiating; American spectrum plate. GROUP IV.—Cadett & Neall spectrum plate (slow). GROUP V.—International "Erethro."

Second.—To decrease the photographic intensity of a colour, a screen complementary colour should be used.

These laws hold good for all branches of photography, whether by transmitted or reflected light, and are not dependent upon the position of the screen, *i.e.*, whether the screen is placed between the source of illumination and the object, between the object and the objective lens, or between the lens and the plate.

In determining the photographic complement of a colour it is more accurate to make photographic analyses of stains and colour screens than to make simple visual analyses.

The same plate and source of light must be used as in taking the photomicrograph, because, as shown above, plates of different makes may differ greatly in their degree of sensitiveness to different parts of the spectrum, and it is a well-recognised fact that different illuminating agents give different spectra. The object for which one should strive in the analyses of stains and colour screens is to imitate as exactly as possible the conditions that will exist in the process of photo-micrography. The spectrographs illustrated in Fig. 3 were made with colour screens in preference to cells of fluid, as the screens are much more convenient than cells, and are quite as satisfactory. The colour screens are made by soaking a cleared lantern-slide in a solution of the desired stain until the gelatine is saturated, then rinsing and removing the surface liquid with a cotton pad. The screen is then dried and covered with a cover-glass as in mounting a lantern-slide. The depth of colour in these screens is dependent upon the degree of concentration of the staining solution rather than upon the length of time the plate is soaked.

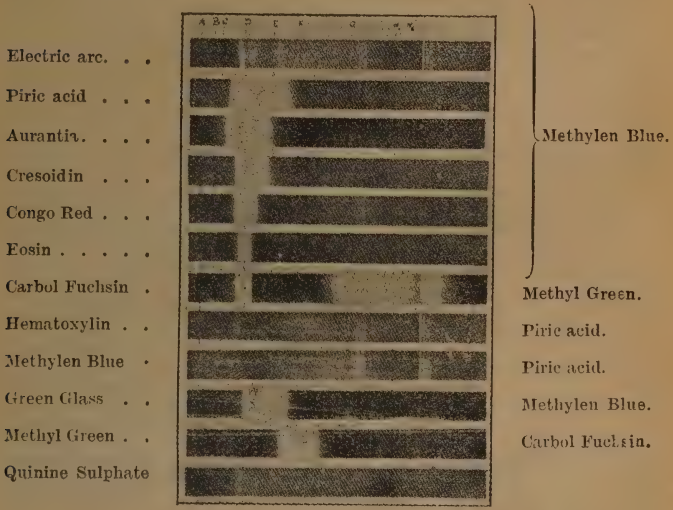


Fig. 3.

Explanation to Plate.—This plate is a reproduction of spectrographic analyses of some of the common stains. The red end of the spectrum is on the left. The principal Fraunhofer's lines are marked. The name of the stain is on the left, while on the right is the name of the proper screen to use to increase the photographic intensity. To decrease the contrast use a screen of the same colour as the stain.

THE APOCHROMATIC COLLINEAR LENS.

(A Paper read before the Royal Photographic Society and reprinted from its "Journal.")

Since the discovery of the principles of achromatism, manufacturing opticians have been endeavouring to make their instruments more perfect by obtaining absolute achromatism. Experiments in this direction were first made in connection with the oldest optical instrument, the telescope, the relatively simple form of which has for a long time engaged the attention of mathematicians, although up to the present the problem of making completely achromatic telescope objectives can by no means be considered finally solved. Remarkably perfect microscope objectives—the Abbe apochromats—are available, and they are found indispensable for critical work. Before drawing your attention to the production and application of perfectly achromatic instruments for the microscope, terrestrial and astronomical telescopes, I would first make a few introductory explanations. All that I have to describe in this paper refers to the problem of correcting the secondary spectrum, as it is usually called. The term secondary spectrum is the name given to the remaining uncorrected colour of an ordinary achromatic telesocpe objective. The correction for the primary colours is generally obtained by the use of two lenses, a converging lens of small dispersion, and a diverging lens of large dispersion, the well-known crown and flint glasses. This kind of combination of two glasses permits of the correction of two colours, and, with the glasses obtainable until quite recently, of only two colours. The precise colours of the spectrum which are to be brought together are naturally determined by the purpose for which the instrument is required. We will take three cases. Firstly, for ordinary visual observations, the telescope objective should be chromatically corrected so that the rays which make the strongest impression upon the retina have the greatest attention, and, consequently, the remaining secondary spectrum does as little harm as possible. Fraunhofer was the first who made accurate research in that direction, and among later authorities, I will only mention Seidel and Schiebner. The result obtained theoretically, which is found to be accurate in practice, is that the most rational division of errors and the utmost efficiency are obtained if the light of the Fraunhofer lines C and F are brought together, viz., the red and green-blue hydrogen lines. This is on the supposition that the object observed be white. If it be coloured, the centre of the spectrum is nearer the red or the blue side. For instance, the telescope used by Schiaparelli in observing Mars was specially corrected for red light, as this observer chiefly desired to see fine details, which cannot be taken up with ordinary telescope object glasses. As a general rule, we are considering that the eye and the eye-piece are achromatic. It would take too long to consider the cases in which the eye and eye-piece show considerable colour.

The above method of correction for visual observations is the opposite to that required for photography. In order to concentrate the actinic rays as powerfully as possible on the plate, the blue-green Fraunhofer F line and the indigo-coloured hydrogen line must be brought together. It must be remembered, however, that we cannot definitely fix the correction of object glasses for actinic light, because the plates used frequently differ very much in their sensitiveness for light of any fixed wave length.

As in most cases, however, only plates which are very little sensitive to physiological light are used, all objectives achromatised for actinic light will have a difference in their focus for the brightest light showing the so-called chemical focus.

This inconvenient property is so harmful that in most cases we are unable to use the rational method of achromatising only for actinic light. There is only one case, that of astro-photography, in whcih this defect does not matter much, as, when taking stars, sharp focussing for infinite distance can be done by means of trial and error. Unfortunately, in all other cases, nothing else remains but to give up the achromatism for actinic light, and to use in its place an incomplete achromatism, namely, by bringing together the two parts of the spectrum in which, approximately, the optical and actinic rays reach their maximum strength. This lies between the yellow line D and the green mercury line on one side and the two hydrogen lines in the ultra-violet part of the spectrum.

Bearing in mind what I have already said about the different methods of achromatising that are possible, it is quite clear that with all instruments the rays of which are regulated in the manner just described, the actinic achromatism cannot be considered, and, further, that in consequence of the want of rational division of the chromatic aberration, the amount of the secondary spectrum remaining is, in this case, larger than in the two other cases of purely optical or purely actinic achromatism.

We will now endeavour to make clear what possibility there is of removing the disturbing remainder of colour of the secondary spectrum, in order to bring instruments in this respect to the highest degree of perfection.

According to Abbe's theory, the optical position of a glass is defined by the refraction quotient for the yellow D line and the dispersion, that is, the different between the refraction quotients and the lines D, C, F, and G between each other. Moreover, the figure V serves to characterise a glass which is found by dividing the dispersion between the F and C line in the refraction quotient N'D after deducting one. By adding or subtracting, as the case may be, the dispersion and the value for N'D, are found the refraction quotients for the single lines of the spectrum, which are used in the examination of an optical instrument, as regards its chromatic properties. Moreover, it is important to consider the partial dispersion which is the quotient of a dispersion between two given lines, and the dispersion between the F and C lines.

In order to give you a small example of the factors mentioned above, I append below the constant for the two forms of glass which have been used in a great number of cases for optical instruments, and from which, both in the present and in the future, the usual twofold objectives have been and will be constructed.

	n_D	$n_F - n_C$	V	$n_D - n_{A^1}$	$n_F - n_D$	$n_{C^1} - n_F$
Hard Crown	1·5179	0·00860	60·2	0·00553 0·643	0·00605 0·703	0·00487 0·566
Dense Flint	1·6202	0·01709	36·2	0·00034 0·605	0·01120 0·714	0·01041 0·609

From these figures, the importance of which you will understand, we can see the extent of the secondary spectrum.

You will observe that the partial dispersions (that is, the figures under the dispersions), for example, between G and F, for both sorts of glass are different. This means that with crown glass in comparison with flint glass, the blue part of the spectrum is shortened and the red part is lengthened. If we bring two colours together, for example, B, C, and F, these colours only will fall together, in consequence of the disproportional degree of refraction of the two glasses, wavelets joined together in different places, so that, for instance, between the images formed by the rays C and D, a difference of focus will exist which is owing to the secondary colour. These disappear entirely in the points where the C and F rays fall together, also in all other points, if the dispersion of both glasses could be made proportional and the partial dispersions equal each other. From this it will be seen that all opticians endeavour to use glasses the dispersion of which is proportional, for constructing their instruments.

I do not intend to go into the history of optical glass, though this subject is an exceptionally interesting one. I would only mention that, apart from a few special experiments, there are three periods of research in the production of the glasses so much desired. The first was in the beginning of the last century by Fraunhofer, of Munich, and Benedicksbeuren. The next was about 1830, by the English clergyman Harcourt, and in 1880 by Abbe and Schott, of Jena. I can only go very shortly into the results obtained by this extraordinary amount of diligence and patience. Fraunhofer was the first to be able to produce glass the size and evenness of which enabled him to produce telescope objectives which gave results, especially as regards astronomical measuring instruments, that were better than the reflecting telescopes which at that time were largely made in England, and which had been used by the elder Herschel with so much success. Neither Fraunhofer nor Harcourt was able to obtain the results so much desired by opticians, viz., the production of glasses with equal partial dispersion. It remained for Abbe and Schott to carry this out, enabling extremely important improvements to be made to a certain class of optical instruments, viz., microscope objectives.

The task Abbe placed before himself was the production of new kinds of glass from two points of view, firstly as regards the proportional degree of dispersion, and secondly in order to obtain a greater range of glasses in respect of the refraction quotient and dispersion. The second problem of the Abbe programme has been solved with most satisfactory results. Up to his time the optical properties of the glass available consisted chiefly in an increasing refraction, which also increased the dispersion of colour; and at the same time only one group of glasses, namely, the silicate glasses, excluding a few slight modifications, was available.

It was only possible to produce glasses which differ from the kinds then procurable and which combine the high refraction of the dense flint with the small dispersion of the ordinary crown glasses by accurate research regarding the influence of all the elements on the optical properties of glass.

These are the new glasses, called barium silicate glasses, without which the modern anastigmat could not be constructed. Their properties are extremely useful in modern optics, as was foreseen by Petzval and Seidel.

The first point of the Abbe programme regarding the production of pairs of glasses, could only be partly carried out. By replacing the principal component of glass, the silica, by phosphoric and boracic acid, groups of glasses are produced which show an important difference as regards the dispersion of colours compared with the older kinds of glass. Notwithstanding that trials in constructing telescope objectives out of these borate and phosphate glasses gave unusually good results as regards efficiency, the use of these glasses for larger instruments proved to be very limited, as they were deficient in point of durability. They therefore proved to be only an advantage for microscopy. The apochromatic microscope objectives first introduced by Abbe proved to be much more efficient in their correction for secondary spectrum than the usual achromats, the new Jena glass completely solving the problem of correcting for secondary spectrum, which Blair, Barlow, and Zenger, among others, had attempted by the use of flint lenses. As previously mentioned, the phosphate and borate glasses have one great drawback which must be taken into account, namely, their want of resistance to the atmosphere. This drawback is not felt so much with microscope objectives, which are in enclosed mounts, as in the case of telescope lenses, which are nearly always exposed.

For this reason, as also on account of the high price of the special Jena glass, it did not come into use for either telescope objectives or photographic lenses. Before going specially into the subject of photographic lenses I wish to give some further details regarding the construction of telescope objectives with improved chromatic correction. In the year 1893, Messrs. Cooke and Son, of York, patented a threefold object glass which considerably reduced the secondary spectrum. This construction was invented by Mr. H. Dennis Taylor, who also brought out the Cooke photographic lens. It is well known that by the use of three lenses made of different kinds of glass, three colours of the spectrum can be brought together. This, however, carries with it the necessity for very deep curves and a long fous in proportion to the aperture. Astronomers will recall the Schmidt experiment, which, however, did not lead to any permanent result. By making use of a Schott glass, which has an extremely unusual refractive index, but which does not share the great disadvantage of the specific Jena special glasses, of being sensitive to atmospheric influences, Mr. H. Dennis Taylor succeeded in reducing the secondary spectrum, thus bringing telescope objectives to a high standard of perfection.

A further advance was made a few years ago by the Jena glass works by the production of two kinds of glass, which, especially as regards the physiological part of the spectrum from red to blue, show an almost proportional rate of dispersion, and which, up to the present, have proved to be perfectly durable. In the astronomical department of Messrs. Carl Zeiss, of Jena, under the direction of Dr. Pauly, telescope objectives have been constructed of these new kinds of glass, which give an unusually good colour correction. The superiority of this kind of apochromats was proved by the researches of Professor Wolf, of Heidelberg, respecting object glasses for visual observation and also an f-10 aplanatic lens which was specially constructed by the firm of Carl Zeiss for astrophotographic work, during the time I was on the staff of that firm. It is hoped that the Jena glass works will succeed in constructing even better kinds of glass, so that telescope object glasses may be constructed which have a larger aperture in proportion to their focal length.

I must here refer to one of the most important improvements in telescopes which have been made since the time of Keppler. It is the medial of Professor Schupmann, a combination of a refractor and a reflector which combines the advantages of both constructions, giving an image that is perfectly apochromatic.

With reference to the optical instrument in which we are specially interested, namely, the photographic lens, the first to take up the question of correcting the secondary spectrum of a photographic lens appears to have been the English optician, Sutton. When he was going into the construction of his panoramic lens he thought it might be possible by a careful selection of the glasses used and the liquid enclosed to remove the secondary spectrum. Further consideration of this idea I cannot enter into now, and only mention it on account of its historic interest.

The work of Adolf Steinheil is of greater importance. He went very thoroughly into the design, and especially the selection of the glasses used for his aplanats. These aplanats consist of strong refracting flint glasses, whose quotient and colour dispersion do not much differ. Consequently the disproportion in the degree of dispersion in both glasses does not differ much, and Steinheil saw a considerable advantage in this reduction of the secondary spectrum. Apart from the not very considerable reduction of the secondary spectrum, however, this small advantage could hardly be considered in Steinheil's time. The photographic methods then in use (about thirty years ago) had not developed to the exceptional degree of fineness and precision that they have to-day. The work of the two French mathematicians, Martin and Wallon, remained without any practical results. Both saw the possibility of increasing the efficiency as regards the achromatism for three colours.

II.

A CONSIDERABLE advance made a few years ago was the Zeiss triplet, which was constructed by Rudolph on Abbe's plan. The correction for axial rays was excellent, but unfortunately the field of view covered was not larger than that of the ordinary aplanatic lenses. This, as well as the want of durability of the special Jena glass used, is probably the reason why these lenses did not come into use.

Although the researches of the two last-named opticians took place towards the end of the last century, it has been only within the last few years that the requirements of several branches of practical photography have become so important that the need has arisen for a photographic lens having complete colour correction, and especially so in the three-colour processes for printing in colours. In the case of the ordinary photographically achromatised lens, *i.e.*, that in which the most powerful physiological and actinic yellow and blue rays are united, the image obtained by the rays of longer wavelets, namely, the red end of the spectrum, lies nearer the lens than those formed by the yellow and light blue rays. The extreme degree of accuracy required for three-colour work, as regards the superimposition of each of the three coloured images, makes the slightest difference in the size and position of the three images extremely damaging as regards the correct mixing of the colours. This is especially noticeable in the contours of objects. It is very desirable to modify the correction of the ordinary photographic lens, so that the special requirements of three-colour process work may be met. Whatever may be done optically or mechanically to reach this end, nothing can be as efficient as improvement in the degree of the achromatism of the lens used.

I hope to have achieved this result by means of the lens which I have now the honour of bringing before you. It is the apochromatic collinear lens, and has been made according to my calculations.

The following details about these new lenses will, I hope, be interesting:—

Firstly, regarding the theory, as previously explained, the secondary spectrum in a system of lenses will disappear when the partial dispersions of all the glasses used are equal to each other. We will now see how this is carried out with the apochromatic collinears. They consist of two holo-symmetrical halves, each of which is formed of three lenses cemented together. The optical details of the three kinds of glass used for this construction are shown in the following table:—

	nO	V	nF–nC	nD–nC	nF–nD	nG^{1}–nF
Heavy Baryta Crown	1·6080	56·7	0·01072	0·00315 0·294	0·00757 0·706	0·00612 0·571
Crown with high dispersion ...	1·5145	54·5	0·00943	0·00277 0·294	0·00666 0·706	0·00543 0·576
Borosilicate flint	1·5408	50·7	0·01065	0·00313 0·294	0·00752 0·706	0·00613 0·576

If you compare the three rows of figures with each other, as in the first example—hard crown and dense flint—you will find that the partial dispersions between C and D, and naturally also between D and F, are equal to each other. This therefore means that if the red rays are united with the light blue rays, they will also be united with the yellow and green rays. In the blue part of the spectrum the case is slightly different. The second and third glasses possess the same partial dispersion between F and G, while the first one differs to the extent of five units of the third decimal point. Actual trials, however, show that this small disproportion is of no consequence. Even in the case of an extremely sensitive telescope object glass, it could only be seen by using equally sensitive methods of testing, which do not come into question in the present case. Moreover, the influence of this small error in the violet rays is reduced by being spread over the whole spectrum up to the C line.

The result is that within the intervals from C to G the colour correction is complete, a fact that has been proved by practical trials in many ways. In by far the greater number of cases the lens will be used for process work; it therefore seemed to me to be useless to give the instrument a larger relative aperture than f-9, and it is upon this aperture that I have based my calculations. It also seemed inadvisable to go beyond this figure, because with the long foci in which this type would usually be carried out, the unavoidable stray reflected light would influence the sharpness of the image if larger apertures were used. It is interesting also to observe that the improvement in the chromatic correction has resulted in an improvement in the correction for spherical aberration, and in reference to this matter the following should be noticed:—The spherical correction of an optical instrument that is the rational compensation of the remaining error, which occurs on account of the different degrees of refraction in the different zones of lenses, is generally arranged for the particular part of the spectrum which has the greatest activity; for example, in the yellow-green rays for ordinary telescope objective glasses. From this it follows, as a general rule, that the compensation of the spherical aberration becomes so much the worse, the farther it is from the position of the greatest activity. The constructor of an optical system has to bear in mind that these departures from the best compensation remain within reasonable bounds. The space within which the spherical aberration of a certain interval of the spectrum moves is called by Abbe the chromatic difference of the spherical aberration. The influence of the same becomes more and more dangerous if the aperture of the lens be increased in proportion to the focus, and for this reason the correction of spherical aberration with apochromatic microscope objectives, with a large aperture, has to be calculated for several positions of the spectrum instead of for only one. Theory and practice have shown, however, that the chromatic difference of spherical aberration is comparatively small whenever the aperture is only a moderate one, as, for instance, f·9. It is without influence on the quality of the image, even in the case of a photographic lens from which the same degree of accuracy is not required, as in the case of a telescope objective.

All this proves to be the case with the apochromatic collinear. Taking a lens of 100 mm. focus, and following the rays on trigonometrical calculations, it is found that the spherical average error or zones for the position of the best correction only measures ·3 mm. This figure permits a very good definition in the centre of the plate. The chromatic difference of the spherical aberration is ·4 mm. This also is only a small amount, and it would be useless work to correct it by a compensated construction.

The object glass comes within the Abbe sinus conditions, and is free from coma.

Regarding the theoretical calculation of the astigmatism and the curvature of field, it rests on the fixing of the image point of a thin ray of light for both the meridional and equatorial sections. The figures obtained this way permit us to suppose that the astigmatic flatness of field is good, and this is proved by the results obtained in practice.

Very important indeed is the accurate test of the results given by this lens with light of different colours. The simplest test that a photographer can conduct is to make direct exposures in the camera. The results obtained in this way fully confirm the theoretical estimations. The images, which the apochromatic collinear gives, of an object illuminated by any kind of monochromatic light, fall in the same plane, and are identical in size. The trials made in my own studio are fully confirmed by numerous experiments made by a number of process workers.

Regarding the small amount of spherical aberration that is found, theoretically, the sharpness of definition in the centre of the field, on account of the apochromatic colour correction, has a degree of precision and fineness that is considerably in excess of that obtainable by ordinary lenses. As in the case of telescope and microscope object glasses which have been corrected for the secondary spectrum, the definition is considerably increased. This enables the sharpness of definition necessary for process work to be obtained with larger stops, and, owing to this, the time of exposure is naturally reduced.

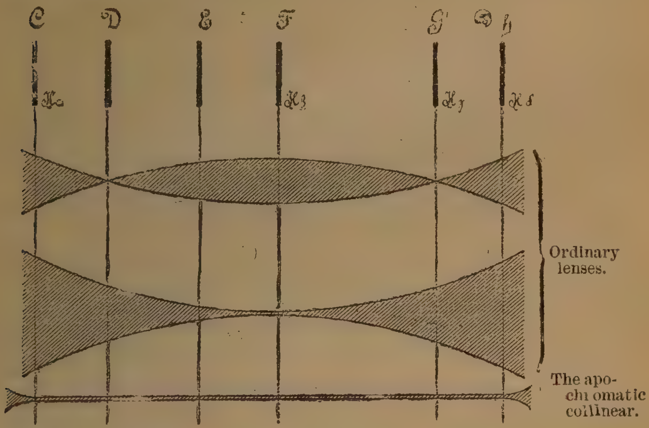
In accordance with the results obtained mathematically, actual photographs prove that the definition on the margin of the field, as far as the anastigmatic flatness of field extends, is especially brilliant.

The apochromatic collinears are at present made in four sizes. 12, 16½, 23½, and 31½ inches focus, and the sizes of plates which the four lenses cover are respectively 10 by 8, 20 by 15, 24 by 18, 28 by 22 inches.

I would draw your special attention to the reproduction of a copper engraving, 18 inches by 24¾, taken with the 16½ inches focus lens, stopped down to f·25. Two things can be seen; firstly, that the necessary sharpness for this kind of reproduction can be obtained with the stop f-25, which naturally involves a considerable reduction in the time of exposure; and, secondly, that the extent of the anastigmatic field of view is as large as the figures given above. You will, moreover, observe that there is no trace of distortion. The example clearly proves the efficiency of the lens for modern process work.

The following details of a few tests which have been made in order to show not only the kind of colour correction, but also the exact extent in figures, are given. This can be done by using a magnifying lens or a telescope eye-piece in connection with the lens as a telescope. The amount of magnification used for these experiments was 40 times. With a lens of 23½ inches focus a magnification of 60 times is equally possible. Firstly, it was seen that by a movement of the eye-piece from the focus of the lens when observing a black object with the sky as a background, the secondary colours that otherwise would be unavoidable were absent, and, secondly, that when accurately focussed the image was seen to have the same properties as would characterise the image on the ground glass.

A second test is extremely sensitive, and shows the secondary colours of a telescope objective at once and gave very satisfactory results. The apochromatic collinear 23½ inches focus is used with an astronomical eye-piece of five-eighths of an inch focus as an astronomical telescope. We must observe the sky through any two black surfaces which are near to each other, such as, for instance, two chimney-pots. If we were to cover half of the collinear lens with an opaque card parallel to the side of the chimney, no difference is seen beyond the natural reduction in the brightness of the image. The sides of the chimney will be seen black and white, while with every object glass which has a secondary spectrum with this test the well-known secondary colours, light green and purple red, will be seen on the sides of the chimney.



An extremely useful method of testing was described by H. C. Vogel, the present director of the Potsdam astrophysical observatory. If an optical instrument be achromatised for photographic work, the rays of the greatest physiological and actinic brightness are united in one point. This is not taking into account the spherical aberration. As a rule, the rays between the physiological and actinic ones come together nearer the lenses than those of the ultra-violet part of the spectrum. At the same time the red, light blue, and violet rays focus in small circles in front of the focus for the actinic and physiological rays. The diameter of these circles depends on the extent of the secondary spectrum. If we place a direct-vision prism between the eye and the eye-piece, the image of a bright point appears as a spectrum with varying breadth. In the positions for which chromatic correction has been made it appears narrower, while at the middle and outside parts of the spectrum it appears wider. This test is one of the most valuable, as it enables us to measure the amount of the secondary spectrum. If, for instance, when the yellow sodium lines and dark blue hydrogen line H are found in focus the difference between the F line and the yellow can be measured by moving the eye-piece till the focus has moved to the F line. The difference in the position of the eye-piece in both places is then equal to the difference of both images for the colours named.

The appearance shown by the apochromatic collinears with this test is quite different from the above description. If a point of light is sharply focussed with a magnification of forty times, the point is seen not as a broad spectrum, variable in width, but as a fine drawn-out spectral line which only broadens in the infra-red part of the spectrum, which hardly affects photography at all. This shows that rays of different colours come together in one point, and that the difference in focus for the secondary spectrum is completely removed. In order to be quite perfect the test requires perfect achromatism of the eye-piece and also of the eye of the observer. If the latter cannot be carried out the chromatic error of the eye-piece and of the eye can be measured in a similar way by means of prisms and an artificial star, and can then be taken into account in estimating the aberrations of the objective.

In conclusion, I should like to mention that the new instrument is very useful for a few other branches of photography; for instance, astro-photography, where rapidity is not so important as large field of view, and specially if accurate definition is required. From the experiments made by Professor Wolf, of Heidelberg, with apochromatic telescope objectives, the conclusion has been arrived at that the images of stars obtained by the apochromatic collinear give considerably more favourable results for measurements than those obtained by lenses having the ordinary photographic correction. This lens will also be of some use for micro-photography, whenever three-colour work is desired with low magnifications. The recent publications of Professor Gaylord, of Buffalo, would seem to indicate that three-colour reproductions of pathological preparations will shortly come to much greater use. I hope the experiments Professor Gaylord is making with a short focus apochromatic collinear will lead to exceptionally good results. The principal use, however, will remain for process work, and the good results already obtained will, I think, form the best proof of this. DR. HANS HARTING.

THE FIXING BATH.

(A Paper read before the London and Provincial Photographic Association.)

THE ACTION OF THE FIXING BATH.

Mr. Alexander Mackie gave a short lecture on the above subject. It seemed to be required, for the reason that the majority of photographers appeared to look upon the operation of fixing as one of such extreme simplicity in practice that it was not at all necessary to have a special knowledge to carry out the process with success. They thought that if at any time necessity arose to investigate the precise action of the fixing operation, they had only to turn to one or other of the text-books to find a complete description of the matter. This was the lecturer's own impression until a few months ago, when, noticing something that did not coincide with his previous ideas on the subject, he referred to the photographic text-books to see what they had to say concerning the process of fixing. In most cases the description was inexplicit and inexact, and in some instances full of discrepancies, but in no case could he find a description that he could reconcile with his ideas of the action of fixing. What he had to relate was his deductions from his readings, and these deductions were amply confirmed by other authorities consulted. The action of fixing was usually spoken of as that of dissolving a silver salt in a solution of hypo. Dissolving in such a sense was not the proper term. It would be correct to speak of dissolving sugar or hypo in water; there the change was not a chemical one, but a molecular change, and by evaporating the water one could reconstitute the solid. The action of the fixing bath, on the other hand, was a chemical decomposition, or, rather, a series of decompositions, of a very complex character. An index to the decomposition that takes place is seen in the process of making gelatine emulsion. Here we have potassium bromide added to silver nitrate; a decomposition takes place, and the bromide leaves the potassium and joins the silver, while the nitric acid radicle of the silver nitrate joins the potassium and forms nitrate of potash. Another instance may be given in the action that proceeds when a negative is placed in bichloride of mercury. The mercury salt acts upon the silver of the negative, and produces a double chloride of silver and mercury in one compound. These double salts have a special interest from a chemical point of view, as they have peculiar properties. For instance, silver chloride darkens under the action of light, but, in combination with mercury, it does not. Mr. Mackie asked the meeting to assume that the fixing bath, in the first place, contained just half the number of atoms of hypo that there were of bromide of silver in the plate. That being the case, the following equation represents the action that goes on:—

$$\underset{\substack{\text{Silver}\\\text{bromide.}}}{2AgBr} + \underset{\substack{\text{Hyposulphite}\\\text{of soda.}}}{Na_2S_2O_3} = \underset{\substack{\text{Sodium}\\\text{bromide.}}}{2N_2Br} + \underset{\substack{\text{Silver}\\\text{hyposulphite.}}}{Ag_2S_2O_3}$$

Such a bath would be rightly described as containing insufficient hypo. The hyposulphite of silver that was produced was an unstable salt, and liable to spontaneous decomposition in time. Supposing, however, that the atoms of silver bromide in the plate equal the number of atoms of hyposulphite of soda in the fixing bath, then the action is expressed by the following equation:—

$$2AgBr+2(Na_2S_2O_3)=2NaBr+Ag_2Na_2(S_2O_3)_2.$$

One obtains a double hyposulphite of silver and sodium, which, again, is not a stable substance. On the other hand, if one takes care that the fixing bath shall contain still more hypo, say three atoms to every two of silver bromide in the plate, one gets the same decomposition, except that a further addition of sodium to the double salt takes place, and this double salt may be easily washed out. The equation is as follows:—

$$2AgBr+3(Na_2S_2O_3)=2NaBr+Ag_2Na_4(S_2O_3)_3.$$

The lecturer took some silver nitrate solution, and in another vessel some hypo solution, placing in other vessels the larger portion of the silver solution and the larger portion of the hypo. He placed the small quantity of hypo in the large quantity of silver, and the large quantity of hypo in the small quantity of silver. In the first case a white precipitate was formed, which would soon turn black. The action was analogous to that when a plate was fixed with insufficient hypo; but in the second case the white precipitate first formed immediately redissolved, and was comparable with the condition of things when an excess of hypo, as should always be the case, was used. In the first experiment the hyposulphite of silver first formed combined with the water-producing sulphide of silver and sulphuric acid, as expressed in the following equation:—

$$\underset{\substack{\text{Hyposulphite}\\\text{of silver.}}}{Ag_2SO_3} + \underset{\text{Water.}}{H_2O} = \underset{\substack{\text{Silver}\\\text{sulphide.}}}{Ag_2S} + \underset{\substack{\text{Sulphuric}\\\text{acid.}}}{H_2SO_4}$$

Such was also the action when a plate was fixed with an insufficient quantity of hypo, and, needless to say, the sulphuric acid was by no means a desirable thing in a plate. The experiment No. 2 represented the action when a plate was properly fixed, although the operation was slowed by the mechanical obstruction to the blending of the two things in the film. Even when the silver bromide had been decomposed, one could see the silver hyposulphite, which had much the same appearance. The next action, in the presence of an excess of hypo, was the formation of the double salt of silver and sodium, which was soluble in water to a certain extent, but a bad thing to leave in the film, owing to its unstable nature. But with pleny of hypo, there still remained the third action—that of the formation of the soluble double hyposulphite of silver and sodium, which could be easily removed from the film. In practice, therefore, one must determine the time required for these actions, so that the plate may be left in a safe condition. One had a guide already to hand in the time of the disappearance of the white silver bromide from the back of the plate. Although this did not determine the time in which complete solution of the silver bromide and its subsequent forms took place, sufficient data was afforded for the estimation of the time it was well to allow to elapse for the complete action. It was a safe rule to leave the plate in the fixing bath for as long again as the time required for the disappearance of the white bromide. In the case of paper prints, this guide was not available, but it was safe to assume that, as the film of silver was much less than the gelatine film in the plate, it would not take longer to fix properly. With reference to the action of the hyposulphite in solution upon the silver image, it was quite safe to leave a plate in the fixing bath for a reasonable time. After ten days he found that no apparent action on the image had taken place in a plate left all that time in the bath. It was thus fair to assume that a few hours more or less did no damage. As regards the strength of the bath, he had little to say. A weak solution of hypo had been found to fix a plate more quickly than a strong one, but these were vague terms. With a saturated solution, however, the action would be slow, and with a very weak solution the action would also be slow, so it seemed logical to choose the happy medium. Although hypo did not act on the silver image when the plate was thoroughly covered with solution, the case was very different if air were allowed access to it, such as would be the case if a negative were removed from the hypo and placed unwashed to dry. The image would soon be affected, so that it was wise to wash the plate immediately on its removal from the fixing bath.

ESSENTIALS FOR SUCCESS IN ALBUMENISED PAPER PRINTING.

(A Paper read before the London and Provincial Photographic Association by George T. Harris.)

It is a debatable point with myself whether I am justified in expecting your attention to-night for even a short space of time while I review in the most cursory manner some details of albumenised paper printing.

To many of you albumenised printing has become little more than a memory, and you look back, self-pityingly, upon those unregenerate days when the silver bath for plates and paper sufficiently met all needs of your photographic life. To others among you the process is mere history, as much played out and almost as bizarre as colza oil for street-lighting. Feeling, as I do, that you may regard this printing process from either of these standpoints, you will scarce wonder that I have some doubts as to the result of my temerity. If I advance any apology for bringing to your notice what many regard as an obsolete process, it must rest largely on the fact that it seems to me regrettable so many latter-day photographers have no opportunity of realising the simplicity and merit of albumen printing now that it has practically disappeared from the workroom and from current literature.

If you were asked to decide upon the technical merit of the silver print of to-day when compared with its predecessor on albumen, I question whether the older workers among you, reflecting on the high-water mark of albumen, would allow that any distinct advance was observable. My own impression, derived from an observation of general professional work, is, that the albumen print possesses a refinement of appearance and a quality of tone not to be seen in the gelatino-chloride print of to-day. Two factors eminently contributive to the popularity of gelatino-chloride are its high surface and its capacity of yielding reasonably good prints from unreasonably bad negatives. Lest I should lay myself open to the charge of bias, it would, perhaps, be wise to state that no one is more fully alive to the superior results of gelatino-chloride in certain directions than am I. For scientific work, as, for instance, photo-micrography, it is, in my estimation, unrivalled. Or, again, when it is necessary to obtain the best possible print from a negative of inferior quality, I am bound to confess that albumen is not so satisfactory as its rival.

The point that I wish to emphasise to-night is the fact that in albumen we have, suffering undeserved neglect, a process capable of giving prints which, as silver prints, cannot be excelled for quality of image, tone, and surface. The manipulative skill required to secure good results with albumen is certainly not greater than with gelatine; for my own part I should say it was much less; while the robustness of the albumen film secures a comfort in working unknown with gelatine. If we compare the relative stability of the two processes, I think the advantage is very largely in favour of albumen. Doubtless many members of the London and Provincial have in their possession albumen prints that count up some thirty or forty years of life, with a vigour and freshness which are an emphatic negation of the assumption that, because a print is a silver print, "Brief life is here its portion." I myself have the greatest confidence in the permanence of an albumen print when it is conscientiously produced. Whether the gelatino-chloride prints now being produced will stand the criticism of a generation of photographers forty or fifty years hence, it is impossible to say.

From this brief review of the merits and demerits of the albumen process, I will pass to the practical working of it, limiting myself to a few points that, in my experience, materially contribute to a successful issue. At the outset, the character of the negative claims our careful consideration. It may be asserted in no equivocal manner that it is useless to expect a rich, finely-toned print on albumen paper from any negative that lacks a considerable amount of quality. A thin, over-exposed negative can never be successfully printed in albumen; neither can its opposite, the under-exposed and over-developed negative. It may be unfortunate, but it is a fact, that any prospective worker in this printing process must resign himself to make negatives of rather an advanced quality. The exposure of the plate should be sufficiently accurate to give a negative in which the deepest shadows remain unveiled, and the density of the negative must be such as would merit the popular term, "plucky." The large amount of success that rewarded the early workers in albumenised paper was, I think you will agree with me, due to the fact that, having only one printing process to consider, they, by a system of trial and error, arrived at a quality of negative accurately adjusted to that printing process. It by no means follows that, to obtain high-class albumen prints, it is necessary to have collodion negatives; equally good prints can be obtained with a gelatine negative if its quality is sufficiently high from a technical point of view. The chief essential, then, for a good albumen print is a negative with unveiled shadows, high lights not too dense, and the general opacity somewhat greater than is usual with negatives for chloride printing.

At the present time the consumer of albumenised paper has not the varied choice that obtained when the process was more popular; but it may be safely asserted that the quality of paper to be obtained in the market at the present time is very reliable, and capable of yielding highly satisfactory results.

Possibly, the salting of the paper is lighter than is consistent with ideal results in albumen printing, for an albumeniser recently told me that he did not advise his paper being floated on a silver bath stronger than 30 grains to the ounce, and this points to an amount of salting that, in my estimation, is much below the normal. Generous salting is conducive both to stability and quality, and a less quantity than 30 to 40 grains per ounce is inadvisable, though I very much doubt whether the papers at present in the market contain anything like this quantity. Lightly salted papers and thin, flat negatives have done very much to bring about the neglect of albumen paper printing. Before passing from the consideration of salted paper, there is one point to which I would like to refer (unfortunately it is a point very largely beyond the control of the phoographer): it is the state of the albumen used for albumenising the paper. Anything but perfectly fresh egg-albumen should never be used, if paper that will keep after sensitising or prints that will last after production are required. It is the very worst economy to buy low-priced alubmenised papers, as the waste associated with their use quickly overbalances the few shillings saved on the purchase, and, what should be of far more consequence to the conscientious photographer, there is always the danger that prints made on other than fresh albumen will fail to stand the test of time.

It will be readily understood that the silver bath is an essential to success which demands considerable attention. When I reflect upon the printing-rooms it has been my lot to see, and the treatment of the silver bath used therein, I cease to wonder that albumenised paper has fallen into disuse. Anything more empirical than the management of the silver bath it is difficult to conceive. My experience has been that disaster was the result, either of working with an insufficient bulk of solution, neglecting to keep its strength to a proper standard, or through allowing it to become acid and charged with organic matter. Formulæ for sensitising baths are given, which contain some such additions as alum, glycerine, or a nitrate of some description; but a plain nitrate of silver bath rendered alkaline with sodium carbonate cannot possibly be beaten. The strength usually recommended is 50 grains to the ounce, and this should be the minimum; I regard 60 grains as a better all-round strength. Great attention should be given to ensuring a neutral bath and freedom from organic matter. Paper from a neutral bath tones more readily than from an acid bath, the tones are better, and less gold is used; while a bath kept free from organic impurities gives prints with purer whites and a paper which keeps very much longer after sensitising.

Preparing sensitive albumen paper that will keep for a considerable length of time is generally accomplished by the aid of citric or tartaric acid, and although the advantage of possessing a paper that will keep for a prolonged period is undeniable, it is doubtful whether the best results are obtainable on paper containing acid as a preservative. Certainly its working is rendered more difficult. I have kept paper sensitised on a neutral bath perfectly white for three or four weeks in the cooler months of the year without any preservative being added, and by sandwiching the sheets between blotting board saturated with sodium carbonate, and then placing the pile under heavy pressure, this period may be easily doubled or trebled. But it should be understood that it was a high-class albumenised paper coated with fresh albumen.

The toning bath is the test of successful working in albumenised paper printing. If the paper is good and the silver bath working at its best, the prints will tone steadily through various shades of brown to brownish-purple and purple. At any one stage, if the negative is of good quality and the paper reliable, the print will be rich and "plucky," and can be removed from the bath when the exact tone to suit individual requirements has been reached. It is to secure this facile toning that such care of the sensitising bath is recommended. Let this bath become acid and contaminated with organic matter, so that the paper prints red and muddy, then troubles of all kinds will make their appearance in the toning bath; protracted toning, bad colour and stained whites. The temperature of the toning bath is a point of considerable importance if reliable and even toning are desiderata; too low a temperature practically stops toning action, whilst over-heating the bath makes it unmanageable, and is inimical to anything like satisfactory tones. My own toning bath is kept at a constant temperature of 70° F., and I find the prints at this degree of heat tone richly in seven minutes from the times of immersion. An element of irregularity is often introduced into the toning bath by neglecting to neutralise the chloride of gold used in making it up. Anything like acidity in the toning bath should be carefully guarded against; in fact, it may be said that, all through the various operations of albumen printing alkalinity is the key-note of success. Even in the fixing bath acidity is a condition the wise photographer will obviate if he values the tones of his print and its stability. Care in fixing is the crown of the photographer's operations in albumen printing, for, as it has been pointed out by, I believe, a member of this association, a well-fixed print is more to be desired than great washing. "Fix thoroughly in two baths made alkaline," should be a motto in every printing-room, and the prints should be continuously separated during the whole time allowed for fixing. Not only is long washing unnecessary; it is detrimental to the brilliancy of the print. The quicker washing operations are conducted the better for the print. Some prints in my possession made about eighteen years ago, which were washed by hand for forty-five minutes, then mounted, are in perfect condition, although no special care has been taken of them.

Before closing I would like to refer to the permanence of a print on albumenised paper. The fugacity of a silver print has passed into a photographic proverb, but I myself fail to see that prints on albumenised paper leave so very much to be desired in this respect, after all. It is not the process, but its exponents, against whom the charge of unstableness should be brought. There are photographic workers who would make of even carbon and platinum evanescent processes were any loophole for doing so left them. Some time ago I picked up at a second-hand bookstall a copy of Hearn's "Practical Printer," published in 1874. The frontispiece is an albumenised print, which shows not the least deterioration, although twenty-eight years old. It is not difficult to estimate from its present condition that another forty or fifty years of life will find it still an excellent print. Other silver prints in my possession are close upon forty years of age, yet are perfectly good. Therefore I am convinced that, if one worked with permanence as a goal, albumen printing might be made a process sufficiently permanent for all practical purposes.

It was my intention to specially print and tone some examples to bring down this evening, but, unfortunately, pressure of business has prevented my doing so, therefore I have to content myself with showing you prints at least three or four years old. I also pass round a negative that fairly well represents the quality necessary to give a satisfactory albumen print, though it would be better with a slight increase of density.

In conclusion, gentlemen, you, even better than myself, know how inadequate to the subject this paper is. My desire has been to lay some stress on cardinal points in albumenised paper printing, the working details of which are matters of common knowledge. If my paper should provoke a discussion in which some of the fund of information possessed by the London and Provincial on the subject be exhumed, I shall be amply rewarded, and shall feel that I have done a signal service to a most deserving process.

George T. Harris.

THE NEBULAR THEORY.

(Abstract of Presidential Address to the Photographic Convention of the United Kingdom, by Sir R. S. Ball.)

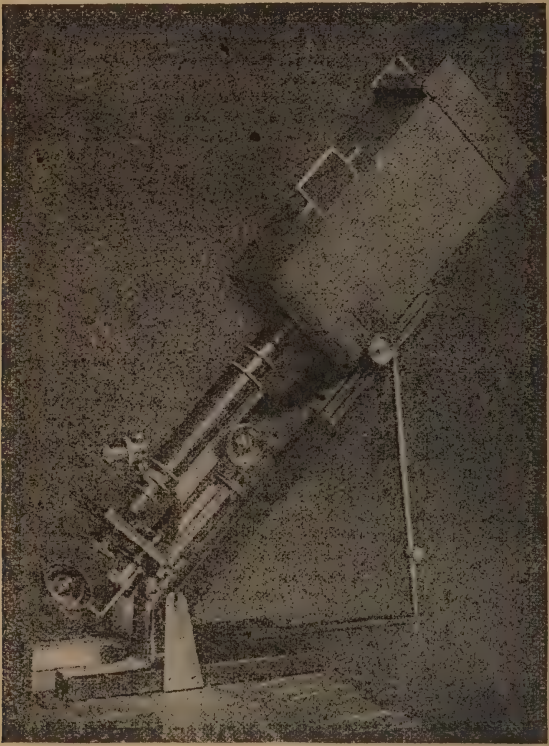
In these days there is no necessity to vindicate the immense importance of photography. Of its innumerable applications I have in the great majority of cases no authority to speak; I shall confine what I have to say to the uses of photography to astronomy, and I shall endeavour to illustrate my subject with the help of the wonderful photographs that have recently been obtained, especially at the Lick and Yerks Observatories. I stand here to-night with a grave task before me. I am called upon to expound, so far as my powers will permit, an exceptionally great subject. How puny do all other things appear in comparison with the great nebular theory. Our personal affairs, the affairs of past, present, and future shrink to insignificance in comparison with what is revealed in that mighty chapter from the book of Nature which we hope to open. The grand transformations through which the solar system has passed, and is even now at this very moment passing, cannot be seen by us poor creatures of a day; they might perhaps be surveyed by beings whose pulses counted centuries instead of seconds, by beings whose minutes were longer than the duration of dynasties, by beings to whom an hour was far longer than all human history. The sun appears constant in size and constant in lustre during the brief interval in which man is permitted to strut his little hour, but the sun has not always been the same; it did not always shine as it does now, nor will it continue for ever to shine as it does at present. Our great luminary is smaller at the end of each year than it was at the beginning; the same is true through indefinitely great periods of time. In a retrospect we see the sun ever larger and larger; there was a time, uncounted millions of years ago, when the sun had ten times the diameter that it now possesses; there was a time when the materials which now form the sun were expanded into a volume of diameter greater than the diameter of our earth's orbit at the present moment. But even when the sun was millions of times as big as it is now it was not heavier; there could not have been appreciably more material in it, but that material was enormously rarefied. Thus our reasoning makes us think of an epoch when the sun was very different indeed from the globe which we know so well. It had then no earth to cherish with warmth and gladden with light. Our globe was in those days truly "without form and void." At the time when the sun was swollen out into this great ball of glowing gas, the materials of the earth were in a condition utterly different from their present state. The earth was then part of the great nebula itself, from which the sun and all the solar system has been formed. Laplace bade us imagine a great primæval nebula or fire-mist. He reminded us how this must be incessantly radiating its heat and gradually contracting. Laplace demonstrated that it was infinitely probable such a nebula would have some movement of rotation; he pointed out the remarkable dynamical law by which the contracting object would gradually accelerate its rotation, and he showed how the inner parts would thus revolve more quickly than the outer parts. Laplace bade us see how the denser parts of the nebula at the centre gradually drew themselves together, so as to form a sun. He showed in like manner how the outer parts of the nebula gradually cohered together to form the planets. By strictly dynamical reasoning, Laplace thus pointed out how from an extensive diffused nebula a solar system, with sun and planets all complete, could be duly evolved in the lapse of ages. Laplace bade us see how the subsidiary systems of satellites appropriate to each planet came into being; he made it plain that these satellites would revolve around their primaries, just as the primaries revolve around the sun; he bade us follow in imagination the progress of the whole system, from the widely-diffused nebulosity—a mere stain of milky light in the sky on the one hand, to an organised system of revolving worlds on the other. If Laplace lived now there are many objects in the heavens to which he could point in triumphant vindication of his theory. The age of photography has dawned, and the photographic plates have not only illustrated in the most marvellous manner the spiral nebulæ discovered by Lord Rosse, but they have succeeded in disclosing many other spiral nebulæ. The photographs have even revealed on the plate beautiful spiral nebulæ invisible to any human eye, no matter what may be the telescope to which it is applied. How strikingly the spiral nebulæ elucidate Laplace's theory. We see in the Great Spiral how the central part is condensed, doubtless in consequence of the fact that the nebulous matter is drawing itself together. We see how the future sun may gradually become evolved, we see how planets also originally "without form and void" gradually come into shape, drawing as they do so their material from the same primæval fire-mist. We have in the photograph of the Great Spiral a marvellous illustration of those principles of celestial evolution which Laplace laid down for the formation of the solar system. I can imagine the astonishment and delight with which Kant or Laplace would look on a photograph of the Great Spiral. If we tried to imagine the best picture of the great primæval fire-mist which has evolved into the solar system, I feel confident we could not obtain anything so effective as the photograph of the Great Spiral. There is also another most remarkable discovery of modern times which has added much weight to the arguments in favour of the nebular theory. If the sun and the earth—to confine our attention solely to those two bodies—had originated from the primæval nebula, they would bear with them as a mark of their common origin a striking identity in material and composition. We do not, of course, mean that the nebula was homogeneous all through. Nature does not like homogeneity. The nebula was evidently irregular, vague in form, dense in some places, greatly rarefied in others. We by no means assert that if we compared a sample of the nebula in one place with a sample of the same nebula taken a hundred or a thousand million miles away from it the two samples would show identity of chemical composition. We need not be surprised at this, remembering that two samples of rock from the same quarry would not be identical. But we may feel confident that the elements present in the nebula will be more or less widely dispersed through it, so that if two globes are formed by concentration in different parts of the nebula, we might reasonably expect that though these two globes would not be actually identical, yet that the elementary bodies which entered into their composition would be in substantial agreement. If one element, say iron, was abundant in one body, we should reasonably expect that the same element would not be absent from the other. Laplace had no means of testing this surmise, but our modern methods enable us to investigate the chemistry of the sun, and have shown that the elements of which the sun is composed are practically the same elements as those of which our earth is built. Is not this a weighty piece of testimony in favour of Laplace's theory? Laplace knew not of these photographic and spectroscopic revelations; he mainly based his belief in the nebular theory on a remarkable deduction from the theory of probabilities. If the evidence thus derived seemed satisfactory to Laplace one hundred years ago, this same line of evidence, strengthened as it has been by recent discoveries, is enormously more weighty now. Laplace was able to count up about thirty instances in which movements of revolution and movements of rotation in the solar system had a common direction. The mathematical mind of Laplace drew a remarkable inference from this unanimity. Here, he said, are thirty different movements, each of them might have been either from right to left or from left to right, but as a matter of fact they are all unanimous. Laplace showed that there were a thousand millions to one in favour of this unanimity being the result of some common cause, and the nebular theory offered such a cause. For as the great nebula was rotating it carried round with it, of course, the masses of nebulæ which were ultimately to form the planets. As each of the planets broke away from the central mass it was found to be revolving, just as the moon revolves round the earth once in each revolution, then as the mass contracted further, its motion accelerated, and the planet came to turn more quickly on its axis, though still at all times constantly revolving in the same direction. In this way the unanimity of the movements was a natural consequence of the nebular theory, and no other method has ever been suggested by which so remarkable a concord could have arisen. Laplace deemed that the thirty common movements were sufficient to establish his argument. But the modern discoveries have enormously strengthened the original argument; there are now 500 objects which revolve around the sun, and they all turn in the same direction. The numerical expression for the probability of the truth of the nebular theory has to be correspondingly amended. The argument has been strengthened countless billions of times. In a notable lecture which Huxley gave in the year 1880 on the coming of age of Darwin's famous book, "The Origin of Species," he mentioned some great discoveries in geology and biology which had taken place since the publication of the immortal work. He then announced that these fresh discoveries brought such wonderful corroboration and illustration of the truth of Darwin's theory that if the famous doctrine of natural selection had not been formed to account for the facts of Nature as they were known to Darwin when he wrote his book, the theory of natural selection would have had to be formed to explain the facts which had been brought to light in the twenty-one years which succeeded. May I venture to make a similar claim on behalf of the great nebular theory? If that theory had not been invented to account for the phenomena which were known to Laplace, it would have had to be invented for the purpose of explaining the additional discoveries which have been made in the century which has since run its course.

A PHOTO-MICROGRAPHIC DEVICE.

(A Paper read before the Section of Photography and Microscopy of the Franklin Institute, at the Stated Meeting, held Thursday, March 6th, 1902, by Mr. F. E. Ives.)

Photography, as a means of recording scientific phenomena, is more used and appreciated every day, and would no doubt be more used than it is if all investigators were fully acquainted with its capabilities, and equipped to obtain satisfactory results without unnecessary expenditure of time and labour. Take, for example, the production of photo-micrographs. Probably most people who use a microscope would like occasionally to fix the image which they see; yet comparatively few do so, because it is generally believed that successful photo-micrography involves the exercise of exceptional skill and experience, special and expensive camera devices, rearrangement of microscope and illumination, in positions comparatively difficult to accommodate oneself to, and much time lost. Undoubtedly there is much truth in this, as photo-micrographs are generally made. It is true that a very small and light camera can be attached to the tube of the microscope, over the eye-piece; but under these conditions the amplification in the photographs is much less than it appears in the microscope, and the optical conditions are not of the best. After making a series of photo-micrographs in the usual way, with the microscope on a special stand and the tube disposed horizontally, I recently set myself the problem of providing for the reproduction of the image observed in the ordinary use of the microscope, without any re-adjustment whatever, without touching the microscope, or even re-focussing. I made the conditions that nothing should interfere in the slightest degree with the comfortable use of the microscope in the usual way; that it might be used at any desired inclination or tube-length, and with any convenient source of light; that the adaptation and removal of the camera should occupy very little time, and that the amplification in the photograph should always correspond to that in the microscope. After some study I set to work and managed, with a box-lid, two small shelf-brackets, the bed and rack of an old 4 by 5 camera, a box originally made to carry some $2\frac{1}{2}$ by 3 plate-holders, a 10in. focus lens, and some minor odds and ends, to produce the device which I now bring to your notice, and which fulfils all of the conditions I have named.

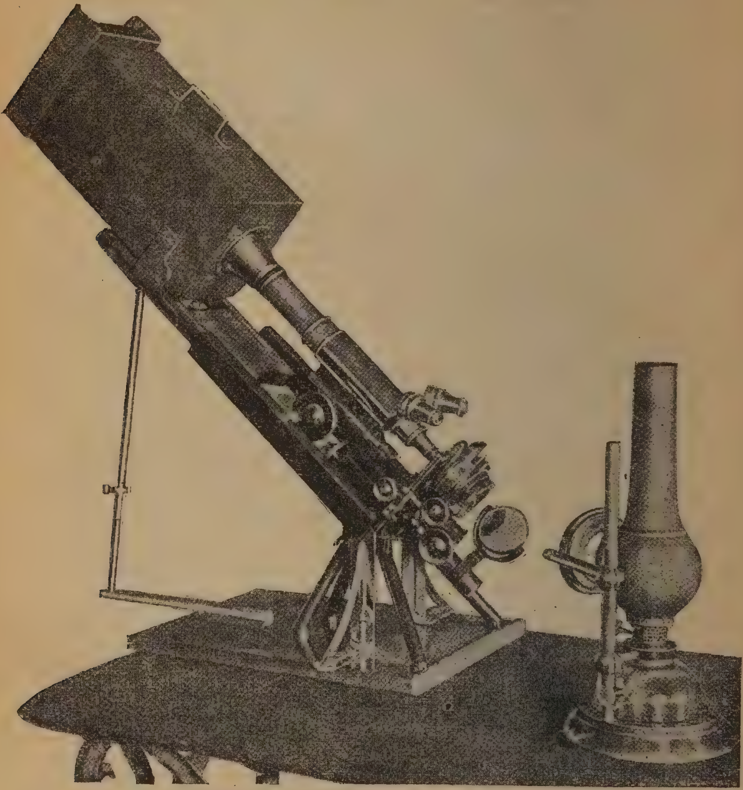
To commence with, we have the box-lid, a clamped piece of $\frac{1}{2}$in. mahogany, about 10in. wide, and 12in. long. The microscope is used on this as a base, on which it is held in place by stops against which it is pushed. This base is necessary to provide a fixed support for the camera attachment without touching the microscope itself. Next we have one of the small shelf-brackets, securely attached to the baseboard on each side of the microscope, in such manner that one of the screw-holes in the end comes exactly opposite the centre of the joint of the microscope. They are separated just sufficiently to clear all the working parts of the microscope. The screw-holes in the brackets are the points of attachment for the camera device, and must occupy such a position in order that the camera may swing from the same centre as the microscope body, and thus be adjustable by a single movement for any desired inclination, from horizontal to vertical. On a double pillar microscope, and even on the Swift portable, which I am using, the camera attachment could be adapted to swing from the centres on the microscope itself, and the



special base and brackets thus dispensed with; but with the usual horse-shoe base "Continental" stand the bracket supports are necessary. The total height of the bracket supports for a Bausch and Lomb "BB" stand is not over 3½in., and they are not in the least in the way of anything one ever wants to do with a microscope. A detachable double upright can, however, be used, if preferred, and fastened to the microscope base at a moment's notice.

The camera is a simple box, with a lens at one side, and fitting for a plate-holder at the other—the lens of 10in. focus, and the distance from the lens to the sensitive plate, 10in. This length of camera insures an image having the same amplification that would be calculated for that in the microscope, provided that its lens occupies the normal position of the eye above the eye-piece. The 10in. camera and lens are used on the assumption that the position of the objective and eye-piece cannot be altered without altering the character of the image; that the rays forming each pencil of light emerging from the eye-piece are parallel to each other when the microscope is focussed, and that the camera must, therefore, focus parallel rays in order to make a sharp image of the microscope projection at the focal plane without re-focussing the microscope. This assumption is correct under certain conditions, which I shall specify later. I did not have a 10in. focus lens, but had 12in. and 60in. plano-convex lenses. A pair of these cemented together made a crossed lens of about 10in. focus, and I mounted it in an old view-lens tube, so that the flattest side comes towards the eye-piece, but 1in. back from the eye-point, when the mounts almost touch each other. I should not have used this lens mount, because, although it does not affect the focus upon the ground-glass to move the lens back from the eye-point, it does alter the size of the image by bending the outer pencils of the cone of light in towards the middle. One should either use a double-convex lens at the eye-point, or a lens of longer focus above the eye-point, in combination with a correspondingly longer camera, in order to keep the amplification strictly correct. On general principles, I would not select a non-achromatic lens for this purpose, and do not recommend it; but it happens that with some achromatic objectives and huygenian eye-pieces, a non-achromatic lens gives the best projection. It does not make much difference whether it be achromatic or not if monochromatic light is used for photographing, which is what I recommend with this method of working. The fact that objective and eye-piece combinations do vary somewhat in this respect, makes it a safe rule to photograph with approximately monochromatic light of the brightest part of the spectrum, thereby insuring definition equal to that seen in the microscope.

The camera has a rack and pinion movement on a base-board having two rigidly attached arms extending forward, and carrying pins to engage in the screw-holes of the brackets, I have cut slots into the screw-holes, so that the pins drop into place, and provided an automatic lock which prevents the pins from being lifted out except when the camera is swung below the horizontal plane. An adjustable telescopic strut and detachable extension to the baseboard supports the camera, and fixes it at any desired inclination. It is in alignment with microscope tube when the camera lens-mount and the eye-piece are concentric with each other when brought together by the rackwork. For optical reasons, strict alignment is far less important than it would be with a camera containing no lens. It takes me from 20 to 30 seconds to attach the camera and adjust ready for an exposure. A colour screen is then (usually) placed between the source of light and the microscope mirror, admitting approximately monochromatic light of such colour as the objectives are best corrected for. Plate-holder is then inserted, and exposure made, using an isochromatic plate. Photo-micrographs made in this way, ranging from comparatively low amplifications up to 1,500 diameters, cannot be distinguished in character or quality from similar ones which were made after most careful preparation with far more elaborate, expensive, and troublesome photo-micrographic apparatus. Heretofore, I have done this work on a specially heavy table, legs resting upon rubber buffers, heavy marble top also resting on rubber buffers, an inch board resting on coils of rubber tubing. Without these precautions, I had trouble with vibration when the microscope was used in a horizontal position. I have been using the new device on an ordinary table,



and have been surprised to find no difficulty whatever with vibration, so far. The microscope appears to be far less sensitive when inclined at approximately 45deg. angle than when either horizontal or vertical. I exposed two hours on an amphipleura with oblique light from a Welsbach burner, and the lines came out sharp. Most subjects with central light, require only one to five minutes' exposure, using rapid isochromatic plates.

I have stated that one of my objects was to avoid the necessity of refocussing the image, which is objectionable, both because of the time it takes and because it alters, however slightly, the character of the image. The conditions under which no refocussing is necessary are, that the camera lens shall focus parallel rays at the focal plane of the camera, and that the microscope shall have been focussed with an eye that focusses perfectly parallel rays upon its retina. Under these conditions, the rays forming each pencil of light emerging from the eye-piece are parallel to each other, and will therefore come to a perfect focus at the focal plane of the camera. If the microscope were focussed by a short-sighted or an abnormally far-sighted eye the rays forming the emerging pencils would not be parallel to each other, and therefore would not come to a perfect focus at the focal plane of the camera. Huygenian eye-pieces, and some others, are calculated for an eye that focusses parallel rays, and cannot give the best results to either a short-sighted or an abnormally far-sighted eye. A short-sighted person sees an image which is formed above the correct plane in the eye-piece, and an abnormally far-sighted person sees an image which is formed below the correct plane. A person having theoretically normal sight will focus the microscope correctly, not only for the best image obtainable, but for the focal plane of any photo-micrographic camera. Anyone whose eye is not theoretically normal will have to re-focus on the ground-glass of the camera when using low powers; but when he has done so, the image will be exactly what it should be. My own eyes are short-sighted, and in pursuit of my object I have as nearly as possible overcome this difficulty by providing myself with a compensating lens in a mount, which fits loosely over the eye-pieces of the microscope, and makes my vision, for the time being, theoretically normal. As this lens belongs to my eye, and not to the eye-piece, I remove it after focussing. This procedure is equivalent to wearing spectacles adjusted for clearest vision at very great distances, which anyone may do; but the eyes of very young people, with great powers of accommodation, may not even then be trusted implicitly when working with very low powers. With high power objectives and eye-pieces, hypermetropes, emmetropes, and moderate myopes, focus practically all alike. This new outfit is not calculated to supersede some of the very elaborate and expensive photo-micrographic apparatus and devices which have been produced by Zeiss and others for some special purposes. It will not produce photographs of large size, such as can be made with projection eye-pieces and very long cameras, nor include wide angles of view in low powers, such as may be obtained with Zeiss planar lenses without eye-pieces; but it should be far more generally useful, because it can be relied upon to reproduce clearly whatever detail the eye sees in the microscope, and with the least possible cost, either in time, labour, or expenditure for equipment.

It will be evident that the same camera and procedure as to focussing is adapted to making records with telescopes, spectroscopes, and some other optical instruments.

SCREENS AND DIAPHRAGMS FOR HALF-TONE AND THREE-COLOUR WORK.

(A Paper read before the Camera Club and reprinted from its "Journal.")

It may be within the recollection of some who are here to-night that just over eight years ago, namely, on March 8th, 1894, Mr. F. E. Ives read a paper before this club—I am not sure whether actually in this room—on a similar subject to that which I propose to deal with to-night. That paper I look upon as possessing quite historical interest, because it was the very earliest publication of the principles underlying the modern half-tone and three-colour processes, which in these eight years that have elapsed have made such enormous strides, and reached such a high stage of development, besides giving evidence of such immensely greater possibilities in the not distant future. It is worthy of note that in this paper Mr. Ives referred to his use of the cross-line screen so early as 1886, whereas at the time of reading the paper the screen had hardly been introduced into this country. He also pointed out that the function of a cross-line screen was to produce pin-hole images of the aperture of the lens diaphragm, that there was a correct distance for the screen from the sensitive plate, and that the shape of the dot image could be regulated at will by changes in the size and shape of the diaphragm aperture; whilst further he set forth in the most explicit manner the necessary conditions for working the three-colour process and the making of the screens for it. In fact, it must be admitted, in spite of all that has been done during the past eight years, that there is little to add to the principles that he then laid down, and my paper to-night must cover pretty much the same ground, though, of course, I have much to say of improvements in detail, and of novel modifications of his methods. The point I wish to emphasize is that the fullest credit is due to Mr. Ives for his prescience and the knowledge he so early displayed and imparted to the world at a time when these precesses were only imperfectly understood. At the same time, there is some credit due to your club for so early discovering Mr. Ives, and extracting a most interesting paper from him. With this little reminiscence I propose to leave the historical treatment of the half-tone process, and proceed to describe to you, and I hope interest you in, some of the technical and scientific features of the application of the half-tone and tri-chromatic principles.

In the first place, let us look at the half-tone screen. The Levy screen is the standard article almost universally used. It is manufactured by a neighbour and friend of Mr. Ives, in Philadelphia, Max Levy, who has often frankly acknowledged the assistance Mr. Ives has rendered him. Max Levy is a man of great inventiveness and resourcefulness, besides having infinite patience and determination, and these gifts have carried him through the enormous mechanical difficulties incidental to the delicate operation of ruling these screens. He has designed and constructed his own machines, grinds his own diamond points, polishes his glass by novel machinery, and now expresses his intention—probably half carried out by this time—of making his own glass, owing to the difficulty of getting it in the market free from bubbles and other imperfections. The glass at present used is a beautifully white crystal patent plate, imported from France, about one-eighth inch thick, which is thinned down to about three-thirtyseconds inch thickness in the necessary grinding and polishing. So far as we know of Levy's method, from the description he has allowed to be published, the routine of manufacture is as follows:—The glass is coated with an etching ground which is resistive of hydrofluoric acid, and is at the same time capable of being cut through in lines by a diamond ruling point, ground to a U shape. The glass is fixed to the bed of the machine, and the diamond point is fixed in an arm which traverses it, very much like the ram of a shaping machine. The plate is ruled at an angle of 45° to its sides, and an ingenious feature of the ruling mechanism is that the arm carrying the tool automatically adjusts its stroke to the length of line it has to cut starting with a stroke of about 2in., and increasing the length of every stroke until it reaches the central diagonal line, after which it gradually diminishes to 2in. at the opposite corner. The times as well as the length of stroke is altered, as uniform ruling requires uniform speed. The machine is started and runs on automatically day and night until the plate is finished. It would be fatal to the evenness of the ruling to stop the machine.

I do not know the time required for ruling a plate, but the cycle of operations necessary for the stroke and return of the point and the spacing for the next line must necessarily be slow on a machine of this character, especially as the diamond point must be drawn very slowly over the glass plate. If we take the largest plate Mr. Levy can rule, viz., 48in. square, which would give a diagonal of about 68in., the interesting calculation can be made that a screen of 100 lines per inch would require about 66 hours for each of the two plates required to form the cross-line result. For the four-line screen, which I shall presently describe, the lines are crossed on the one plate, and the adjustments of the machine have such a degree of accuracy, that the plate can be removed after the first ruling to its position for the second with such precision that the corner of a 24-in. square plate will not be more than 200000th of an inch out of the position it should occupy to make the lines cross at a right angle. Mr. Levy has said: "We can set the machine with all care, watch it and tend it, perhaps for a week, and at the end of that time the result may be success or it may be failure." When the ruling is finished, the lines are etched with acid, the resist is polished away, and the furrows formed by the etching are filled with a black made up, something like a printing ink, from the finest possible vinecarbon. Some time ago Levy experienced great difficulty with his black filling, all the blacks he could get having an oily constituent which was dissolved out by the balsam used for sealing, and rendered the ransparent spaces of the screen somewhat yellow. This led him to abandon the carbon filling, and use a dark-red substance, but it was strongly objeced to by the process operators, who had become accustomed to the black lines, and imagined that their troubles in the making of the negative were due to the new filling. It was stated that the latter increased the exposure, although Levy himself put it forth as an advantage that it really decreased the time. However, he had finally to yield to prejudice and return to the black filling, having evidently found ways of overcoming his earlier troubles. The difficulty of obtaining good balsam for sealing the screens together is another which Levy has experienced, so much so, that when he finds a good sample of balsam he will buy up the whole of the same kind on the market. Mr. Ives has also referred to the same difficulty in regard to the balsam required for making colour screens. Canada balsam is the kind used, but it must be in the liquid form as it oozes from the tree, and is used after simple filtering through muslin. The balsam found on the English market has been dried and the lumps re-dissolved in turpentine. The baking of the screen to dry the balsam after sealing is an important operation, which is done, I believe, with the screen under pressure, the heat being applied by a steam chest underneath.

The largest effective size of screen Levy can produce is, I believe, 42in. by 32in., and one of this size is in use at the Ordnance Office, Southampton, where it is stated to be kept under lock and key, and the door probably guarded by a sentry. I suppose it is quite an interesting ceremony when the screen has to be given out for use, and one can imagine that it requires no end of permits, if not, indeed, the presence of the commanding officer. As the screen is worth something like £250, it would be a serious matter if it were broken. It is, as you may imagine, no joke to break even a small Levy screen, though it is a not infrequent occurrence in some of the process studios. I have heard of one unfortunate operator who is "doing time" for such a mishap—I don't mean in a gaol, but simply that, being a conscientious man, he offered that he would work so many hours a week overtime until the damage was compensated for. His penance has already gone on for two years, and I don't know when it will cease. In another case, a well-known firm bought a four-line screen, and it was dropped on the floor before it had been in the camera at all, whilst the operator was examining its peculiarities. I suppose, in that case, something like £25 went "bang" with as much expedition as the Scotchman's proverbial "saxpence." Screens which are scratched, chipped, and otherwise partially damaged can be sent back to the maker for repairs, and come back equal to new. Levy used to have the distinction of being the only man in the world who could make half-tone screens; but that is not so now. Wolfe, a competitor who used to make collodion copies of rulings, now supplies original engraved screens which closely resemble Levy's. In this country, Johnson, of Leicester, makes screens, which seem to give satisfaction to some operators. Similar screens are also made in Germany, by Haas, of Frankfurt. France has no manufacturer of screens, and the Academy of Sciences offered a prize some years ago to any manufacturer who could successfully start an industry in France. Passing from these generalities about screens, let us examine the nature of the screen-ruling more particularly.

In the first place, I daresay you are all aware that screens are made in varying degrees of fineness, which means that they are ruled with a greater or less number of lines per inch. Screens can be ruled with any number of lines per inch, from 50 to 400. Until quite recently, 240 lines was regarded as the limit of fineness, and seldom more than 200 lines per inch was used in the regular commercial practice. But now Levy has ruled 400 lines per inch, and I am able to show you a piece of such a screen here to-night, which is, in fact, the only piece at present in this country. The lines are invisible to the naked eye, and it looks just like a piece of smoked glass. The ruling is very perfect, and, under the microscope, I find that the black lines are thicker than the transparent spaces, whether intentionally so or not I do not know. This 400-line screen is not merely a curiosity in rulings, but has been actually used, and yields blocks which are almost as easy to print from as much coarser ones. The tones of the pictures are practically continuous to the naked eye, and the result closely resembles collotype. These exceptionally fine rulings make excellent photogravure plates for intaglio printing, and they are exceedingly useful for the reproduction of microscopic subjects, where the finest detail must be held. Coarse screens give bold contrast, with a lack of detail, whilst fine screens give detail, but with some flatness. The coarse screens make very good poster pictures, but, as a rule, screens actually ruled coarse are not used for this purpose, for one reason, because of the large size which would be required, and consequent expense. The usual plan is to make a small negative with a screen of some ordinary ruling, and an enlarged negative from it. Recently a method has been patented called gigantography, by which a screen of ordinary degree of fineness is placed in an enlarging lantern at a properly determined distance from a positive picture, and the latter is projected together with the screen effect on to a sensitive plate of any desired size within the usual limits. The coarseness is in this case simply governed by the conjugate distances of the projection apparatus, so that one screen will do for all cases. Not only does the number of lines per inch vary, but also the relation of the black line to the transparent spacing. In the screens now most commonly used the relation of black to white is 1:1, and, consequently, the width of the transparent opening will be a fraction whose denominator is double that of the number of the lines per inch. For instance, 100-line screen one-twohundredth inch opening. But in some screens the relation will be found to be perhaps 5:4 or 4:3. Rarely is it in the reverse proportion. This relative thickness of line has a great influence on the working and the character of the results. In the extremely rare case where a screen has been ruled accidentally or intentionally with the lines on one plate thicker than the other, an oblong opening is formed which produces on the negative elliptically-shaped dots. Apart from such abnormal results, you can readily see that the thickness of the ruling will have an influence on the exposure and on the gradations of the negative. In the case of a 1:1 ruling, three-quarters of the area of the sensitive plate is screened. Consequently the exposure must be at least four times what it would be if the screen was not there. As a matter of fact, the exposure with the half-tone screen is generally put at five times ordinary, the time over and above that due to opacity ratio being probably accounted for by reflection from the surface of the screen—which in the case of lenses is something like 8 per cent.—and to loss by refraction in the glass, as well as by absorption in the balsam. The fact, too, that the plate is so heavily screened, and the stops used comparatively small, probably affects the inertia constant of the plate.

It has been suggested that a screen with its opacity arranged in chess-board form would be better than a cross-line pattern, as the former would only screen half the area instead of three-quarters, as in the latter case. Such a chess-board screen can be produced in various ways. For instance:—(1) A plate of glass can be covered with an opaque ground, and ruled through so that isolated squares of opacity are left. Another exactly similar plate is superposed with its squires displaced the space of one square in a vertical direction and the space of one square in a horizontal direction. Another way, patented by Levy, is to take two cross-line screens, one ruled diagonally and the other parallel to the sides, and so fit them together that the one cuts off the corners of the openings in the other, and gives a chess-board pattern. (2) An easy way of photographically making a chess-board is to make a half-tone negative from a sheet of white paper, taking pains to get sharp square dots on the negative, arranged in chess-board form, which, as I shall presently show, can be done by means of a suitable stop in the lens. It is surprising what perfectly sharp and clear chess-board effects are got in the best wet plate negatives by careful manipulation. (3) A more ingenious way than any for making a chess-board screen was devised by Mr. Deville, the Surveyor-General of Canada, who some years ago made some most extensive and interesting researches into the theory of the screen working. His method consisted in placing a cross-line screen in front of the sensitive plate at a suitable distance and, in place of the lens, having a diaphragm, perforated by a pinhole. An electric arc light is directed by a condensing lens to this pinhole, and the result is a series of sharp-edged isolated squares on the sensitive plate. Another pinhole is then uncovered, its distance from the first being such that an additional set of squares is printed so as to exactly fit between the set first printed, and form a pattern like a chess-board. The plate is developed and fixed, and then forms the screen. It is an interesting fact that a chess-board screen can be made into a cross-line screen by closing up alternate holes diagonally. We have then added one-quarter more opacity, whilst also covering up squares which would have given double the number of dots, and, consequently, we must have lost in value of tone rendering. Deville says the aperture of the diaphragm with the cross-line screen should be twice as large as with the chess-board screen, but the exposure is the same for both, because there is never more than one-half of the aperture visible from the plate through the cross-line screen. That is to say, the diaphragm aperture is placed with its sides at 45° to the lines of the screen, whilst in the case of the chess-board screen, the aperture is symmetrical to the openings of the screen. This rather disposes of the idea that the chess-board screen will reduce the exposure. Deville further says that in order to produce with a cross-line screen as good a result as the chess-board screen, the adjustments of the screen, plate, and diaphragm would have to be three times more accurate and the screen itself three times more perfect. The same authority strongly recommends vignetted screens, which he defines as a screen that is "semi-opaque over its whole surface, and divided into minute zones of varying degrees of opacity." That is not a very lucid definition, and requires a little elucidation.

The screens I have so far brought under your notice have what may be termed sharp-edged opacity. They are simply black lines or squares with transparent spaces. But consider a case in which the lines or squares have no sharply defined outline, but graduate from perfect opacity to perfect transparency. The chess-board dot would be a pyramid of density, and only the very centre of the space between would be clear glass. Such screens were in use in the early days of the half-tone process. Mr. Ives used a line screen of this nature, and Dr. E. Albert, of Munich, made the idea the basis of a patent. Yet I know of no one who is using such a screen to-day, so that it is reasonable to assume that they possessed no special advantages over the present opaque line screens. It is singular, therefore, that Mr. Deville should so strongly advocate them. He says:—"In theory, the vignetted screen is the most perfect one for the photo-mechanical process, because correct prints may be obtained from thin or intense transparencies by using thin or intense screens, while in copying from a negative through a chess-board screen the negative must be of the right density to give a correct print." A vignetted screen must be placed in contact with the sensitive plate, and therefore only dry plates can be used for it. The screen cannot have a glass cover, so that it is easily damaged. One advantage is that the shape and size of the diaphragm is immaterial, and so is its size provided it is not too large. A transparency may be copied in a printing frame without using a camera at all. In this case the frame must be exposed to a point of light, such as an electric arc, and the frame must be kept in the same position during the whole exposure. This process reminds me that my friend, Mr. J. A. C. Branfill, worked some years ago with considerable success a half-tone process in the printing frame, but used the cross-line Levy screen, which he placed in the printing frame, the screen being placed in front of the positive transparency with a certain separation between dependent on the usual conditions of screen distancing. The source of light was an enlarging pattern with a square stop in the objective. Dr. E. Albert, of

Munich, has also introduced a process of this kind for producing a fourth negative for colour work. The only difference between his method and that of Deville's and Branfill's, which I have just described, is that, instead of using one-light point, he uses several—in fact, a number of incandescent lamps. The only effect of this that I can conceive would be to reduce the exposure, the principle being the same as using diaphragms with multiple apertures, about which I shall have something to say presently. The important reason why Albert desires to reduce his exposures is that he is making an actual print on to the bichromatic sensitised zinc plate by this method.

There is another form of ruled screen which deserves a reference, viz., Levy's four-line screen, although it is now practically withdrawn from the market on account of the very great difficulties attending its commercial production. I have here a piece of such a screen, and I will project on the lantern sheet an enlargement of it, from which you will see its peculiar pattern. Actually it consists of two glasses, on each of which a cross-line screen is ruled, one being at 45° to the sides, and the other parallel to the sides. The lines on each screen are not equal in width, nor are the spaces anything like the 1:1 relation. I estimate the opacity of this screen to be equivalent to 0·65 of the area, which results in its passing about 10 per cent. more light than the ordinary 1:1 cross-line ruling. The advantage claimed for this screen is that it admits of greater variety of texture in the half-tone black, that it holds more detail, and the full values of light and shade are better rendered. An interesting optical peculiarity about the results from it is that, where a sharp straight line, such as the rigging lines of a ship, would be rendered with a saw-tooth edge by the ordinary cross-line screen, the four-line screen will render them with a straight opaque edge. That seems to corroborate the statement that the screen does not chop up the detail so much. The dot effect produced on the negatives is very peculiar, as you will see by the slide I project herewith, and by comparison with the subsequent slide from an ordinary half-tone negative. Screens of circular dots have been tried, but have not been found to possess any advantages. The use of "bolting cloth" can hardly be treated as a practical alternative to the screen, though it was common in the days before ruled screens were as good as they now are, and probably if we had known as much about the principles of screen working as we do now, greater success might have been attained with this material. It might be worth trying again in the light of present knowledge for the production of novel effects—perhaps it would suit very well for reproducing some of the work of the impressionistic school of photography. I wonder some of that school do not study the half-tone process. They might produce some truly remarkable results by utilising the screens and diaphragms we make use of in this business, and the interesting feature of the results would be that it is highly improbable anyone would find out how they were done. The effect produced by the use of "bolting cloth" can be very much improved by giving it a slight angular displacement during the exposure. This was suggested to me by Mr. Branfill, and he showed me some very pleasing results in half-tone, produced in this way something like 14 years ago.

I may here say a few words about an interesting method of making half-tone blocks which does not involve the use of the screen at all, and may eventually supersede it. I refer to the Amstutz Acrograph process. Briefly, this consists of making from an ordinary negative a carbon print, which should have a fair amount of relief. Such a print I have here. A piece of thin celluloid is laid over it, and the two strained over the cylinder of a little machine, which at first sight is very much like a type-writing machine. The cylinder revolves continuously, whilst a V-shaped cutting tool is pressed against the celluloid and cuts the equivalent of a screen thread on it, with this important difference, that the thread varies in depth, and at the same time the cut space varies in width. This is due to the tool's rising and falling as it passes over the carbon relief which backs the celluloid. There is a tiny sapphire point continually pressing down the celluloid in front of the point. The result of this action is that the photographic tones represented by the varying relief of the carbon are faithfully reproduced in the engraved lines. The result is as you see on the slide I now project. The celluloid can be printed from right away, or it can be electrotyped, stereotyped, or transferred to zinc and etched. The process is very rapid, the actual cutting only taking about two minutes, whilst the whole of the operations, including the making of a negative and a carbon relief, can be done within an hour. The process seems likely to be very good for daily newspaper illustration, especially as the blocks are cut deep and print well. The average depth of a 125-line half-tone in high lights has been found to be ·0015 inch, whilst an acrotone is ·002.

Let us now consider briefly the matter of irregular-grain screens such as are now becoming popular. The very earliest experimenters in process work down to the very latest have believed that the ideal breaking-up method would be one of irregular grain, yet the productions resulting from carrying out this idea have not so demonstrated its superiority, except for certain classes of work eminently suited for such scheens, viz., for broad effects in painting, drawing, and photography. When it comes to rendering fine detail and delicate light and shade with crispness and clearness, the irregular-grain screen is quite out of it in competition with the cross-line screen.

Mr. Sanger Shepherd was one of the earliest on the market with irregular-grained screens, and his plates were apparently all that could be desired in this way. But the results from the screens were not popular. Whether it was that the half-tone men did not handle the screens rightly, or that the printer made a mess of the blocks, I do not know, but the fact remains that Mr. Sanger Shepherd finds colour-photography a more profitable line to pursue. The late E. Gaillard, of Berlin, also produced some good grain screens, and the Haas irregular-grain screen is another well-known make. So far all these screens consisted of opaque grain, produced apparently in a very similar manner to laying the asphaltum dust ground on a photogravure plate, and the grain was practically the same as is got on a photogravure plate. There can be no doubt that the photogravure grain is a very perfect one for tone reproduction, but it owes much of its success to the method of intaglio printing which is invariably used in conjunction with it. Use the same grain in a screen, or for a relief block without a screen, and the result is flat and dirty. The same objection applies to the use of the collotype grain. Here is an enlargement, 100 diameters of the collotype grain, prepared for me by Mr. W. T. Wilkinson. No grain could be more charming than this in the collotype, printed in the collotype way, but it is generally a smudge when used to produce relief blocks. The fact is, that you must suit the printing process to the grain. That is why the half-tone process only yields its best results when printed on the glossiest paper with very opaque ink, and the most precisely sharp impression. There is one kind of irregular-grained screen now coming into vogue in which I have the greatest faith, viz., the Metzograph screen, invented by Mr. James Wheeler, of Bushey. The previously mentioned irregular-grained screens have probably from a quarter to half their area opaque, but the Metzograph screen has no opacity whatever. It looks like a piece of clear glass, but when examined more closely it will be found to have an embossed grain on one side. This is produced in a peculiar way. Mr. Wheeler is a maker of a pharmaceutical product known as pyro-betulin, which is obtained from birch-bark, and when sublimed it is found to deposit itself on a glass plate in a reticulated grain of any desired fineness. This grain being of an acid-resisting nature, the spaces between can be etched by means of hydrofluoric acid, so that a permanenty embossed granuation is imparted to the glass. When a screen prepared in this way is placed in front and close to the sensitive plate, each of the grain points acts as a tiny lens or prism, deflecting or transmitting the light so as to produce alternate light and dark places. This action can be readily understood by noting the effect of light and shade in the embossed glass used in doors, partitions, and windows. Whatever the precise theory of its action may be, the fact is there that it produces a beautifully grained negative, which yet certain classes of subjects has a very good effect, as the results I pass round will show. This screen obstructs very little light, but as it is necessary to use a very small stop to produce the crispness of grain necessary for the relief block making, the exposure is quite as long as for the cross-line screen. It can be also used in general photography with ordinary stops to subdue detail, and it saves the necessity of a good deal of retouching in portrait work. The screen can be made also to yield an orthochromatic effect by coating it with coloured collodion. It has been suggested that by its use the half-tone and colour screen could be combined in the one exposure. This has also been suggested as an application to cross-line screens, and a patent taken out for it. The colour film, it was proposed, should be between the glasses.

I must now turn to the question of diaphragms for the half-tone process. I think it must be pretty well known to all here that the half-tone workers use square and other shapes of diaphragm apertures other than round ones. A round diaphragm can be used, but is not so effective for forming the screen dot. To understand why that is so, we must fully grasp the fundamental principle of half-tone work, viz., that every aperture of the screens acts as a pinhole lens, and photographs the brightly illuminated diaphragm aperture. Consequently, whatever the shape of the diaphragm aperture, that will be the shape of the dot images on the sensitive plate. Thus a round aperture gives a round dot, and a square aperture a square one. Now let us see which will give the best result. Here is a diagram which shows the range of gradation from high light to shadow in a theoretically perfect half-tone negative. You have three distinct kinds of dots:—

(1) Dots which have overlapped each other in the high lights and formed transparent openings.
(2) Dots which are isolated, but varying in size in the middle tones.
(3) Fine isolated dots in the shadows.

Of course, the print will be the reverse of this, and will give:—

(1) Small isolated dots in the high lights.
(2) Fairly large white dots in the middle tones.
(3) Small white dots in the shadows, becoming invisibly small or covered in altogether in the deepest shadows.

The crux or half-tone negative making is to get all these kinds of dots on the negative at the same time. The first difficulty is to get the joining up of the high light dots, and the difficulty is intensified if you use a round stop. At first, perhaps, it is not joined up enough, and the next time it is joined up too much. You can see it is difficult to get four circular dots to approach each other and let no light between where they touch. The point of contact is so very small. If you make them overlap, you get a very small area of transparency in the space between any four dots. The result is, a very small dot is printed in the high lights, and it is too weak to stand the etching. Now look at the four squares joined up to each other, with their corners overlapping. You get quite a large opening, and, consequently, a good fat dot on the metal to resist the etching. A big dot can always be etched down smaller, and that is why the half-tone negative maker aims to get big openings in the high lights of his negative. To promote this joining up in the high lights, various forms of diaphragms have been used; such as those you see here with extended corners. You can quite understand that the function of their extensions is to make the overlapping more perfect.

II.

A Continental process authority named Fleck has suggested that stops should be cut out with apertures like enlarged spaces of the irregular-grained screens in order to get an irregular-grained screen effect from a cross-lined screen, but I do not know what success attends the use of extraordinary stops. Possibly they might be useful to work with irregular-grain screens. Another class of diaphragms about which very little has been published is, what I may term, translucent stops. These consist of coloured films inserted between the front and back components of the lens, in or near the plane of the diaphragm. I think Mr. Ives was the first to adopt this idea for half-tone, and the method he pursued was to coat pieces of optically-worked glass with slightly yellow-tinted collodion, and to scrape away a clear centre. The diaphragm slot was enlarged to take these stops, and the theory was that they held back the spreading of the dots in the high lights until the shadow dots had time to form, and, in fact, had the same effect as is now obtained by two or more stops of varying aperture. Mr. Sanger Shepherd showed a similar stop at the Crystal Palace Exhibition of the Royal Photographic Society, the only difference being that he used a green film instead of a yellow one. As an instance of the way old ideas are reinvented or repatented, I may mention that in 1901 there was patented a form of light filter for orthochromatic photography, which is known as the Artlett screen, and the description in the specification is exactly the description of the method of making Mr. Ives' translucent stop, which has been in use for ten years or more. The only variation is that the two films are different in colour, one being a strong light yellow, and the other a clear strong red. In the centre of the yellow film is a small circular vacant space, and in the centre of the red film a comparatively large circular vacant space, and the two are cemented together concentric to each other. The inventor states that the screen transmits a small quantity of the very energetic blue and violet rays (along with other rays constituting white light) through the central space left vacant in both films, a large quantity of the green rays (with the red and yellow) through the yellow annular space which intervenes between the central clear space and the red film, and a much larger quantity of the comparatively inactive orange and red rays through the outer red or red-cum-yellow portion of the compound screen.

Another curious stop of the translucent class is called the chromatic balance shutter—introduced in connection with the MacDonough-Joly colour process. The slide I project herewith explains it. The first figure shows a yellow disc and orange sectors over it. The second is a rotating set of orange sectors, and is made to rotate over the first one to produce the effect of the third, which shows the shutter as it would be used. Its object is stated to be to compensate for variations in the taking screens and plates. It has occurred to me that probably a very good form of translucent diaphragm would be a zone plate, which is a plate of glass ruled with concentric circles whose radii are proportional to square roots of the natural numbers. Such a plate can be used instead of a lens, and I see no reason why it should not be used as a diaphragm in half-tone, although I have not had to try the idea. Another idea of Mr. Ives, which may be mentioned in this connection, was a transparent colour cross-line screen, the lines being ruled through a collodion film coloured with "brilliant green" dye. With this screen the closing up of the high light dots is accomplished by the light directly transmitted through the coloured lines where not crossed, and by this means the injury to definition of detail and the outline due to diffraction in ordinary opaque cross-line screen work is practically reduced to about one-fourth. A difficulty which prevents the full realisation of theoretical conditions in three-colour printing is the want of transparency in the inks generally used.

In connection with this matter, I was very pleased to receive recently from Messrs. Fleming some new samples of dry colour, which they had prepared for the purpose of making transparent inks. To test their transparency, I rubbed the colours out on glass with a little mastic varnish, and the result you will see projected in the three slides I show you now. Comparatively, I show you the ordinary three-colour inks, and you will see how opaque they are under the same conditions. I show you also the same inks spread out on white paper and on tracing paper. [The lecturer here showed slides illustrative of the result of this experiment, and also the examples of the same inks spread out on white paper and on tracing paper. He also showed samples of a set of inks prepared by Mr. Edgar Senior, which, when tested by the Abney colour sensitometer, were said to be theoretically perfect. He would like to see these inks tried in colour printing, but so far they had only been made in an experimental quantity.] In considering the effect of colour screens, it is always necessary to correct for ultra-violet, which is generally a bugbear to successful three-colour work. In this connection I have been making some experiments with Tallent's diffraction spectroscope camera, which I have had fitted up with quartz right through. Here is a quartz condenser, then a quartz cell to take the coloured fluid, next a collimating lens, also of quartz, then a quartz prism with one of Mr. Thorp's most perfect grating films mounted on it, and finally a quartz photographic lens. The only possible obstruction to the ultra-violet rays is, therefore, the exceedingly thin film which forms the grating, and it is hardly possible to conceive that this can have any appreciable effect on the results. The spectrum of the electric arc produced with this camera is of extreme beauty and brilliancy, and it extends far into the ultra-violet. By using an "enclosed" arc I am able to get a large volume of ultra-violet, and thereby it is easy to estimate its effect.

I have found one of the very best absorbers of ultra-violet is a strong alcoholic solution of chlorophyll. This gives a dark green tint by transmitted light, and a red surface colouration when presented to ultra-violet rays. It is easy to prove whether the solution is an absorber of ultra-violet by presenting another cell of the solution to the light coming through the first cell. No red surface colouration is visible, and consequently we can assume that no ultra-violet has got through. The same thing may be proved by presenting other liquids to the transmitted light. Paraffin oil and machine oil, which have a beautiful blue fluorescence under ultra-violet rays, are inert when the chlorophyll is interposed. Sulphate of quinine, dissolved in dilute hydrochloric acid, is said to be one of the best absorbers of ultra-violet, but, according to my experiments, this seems to be an absolute fallacy. It certainly gives a fluorescent blue surface tint, but it still transmits a good proportion of the ultra-violet with all the other rays. The visual tests are corroborated by the photographic tests: sulphate of quinine allows practically all the spectrum to pass, even with brief exposures. Aesculin, which is an extract from the bark of the horse chestnut, and is a light white powder somewhat resembling pyrogallic acid in appearance, is a good absorber of ultra-violet. One part dissolved in 500 parts of water is sufficient to make a solution which will act as a screen for the ultra-violet. By transmitted light it is perfectly transparent, but it gives a beautiful fluorescent blue surface colouration when exposed to the electric arc. Its absorption effect on the spectrum is very marked, both visually and photographically. Filters which absorb or subdue the ultra-violet without absorbing other portions of the spectrum may be described as compensation filters, and they are useful in the orthochromatic reproduction of paintings and in spectrum photography. Of these Cadett's Absolutus and Gilvus filters are good examples.

The next class of light filters may be called contrast filters. If it is required to pronounce or exaggerate a colour, a light filter of a complementary colour is used as a contrast filter. Examples of this type are the screens used in photo-micrography and the photography of clouds. Protection filters are known better under the name of safe-lights. Most of you are familiar with the Cadett safe-light, and Rheinlander's safe-lights, which we are now using in collodion emulsion work for lighting the dark-room. The first example shown upon the screen is a red light, and is used for emulsion, which is sensitive to all rays from violet to green, and is accordingly used for preparation and development of the negatives for the yellow and red printing plate. The other is a green filter, and is used for developing the negative for the blue printing plate. It is surprising what a large volume of perfectly safe light these filters give, and it is quite a comfort to work in the dark room under such illumination. The lights are perfectly mono-chromatic, and it is very curious to note the ebony blackness of every red article in the room under the green light. We now come to the question of selection filters, which are those used in the three-colour process. They pick out certain portions of the spectrum, or of coloured pictures and natural objects, whilst absorbing the other parts, and approximately the colours of the screens are red, green, and violet. In the case of some sets, orange, green, and violet would be a nearer approximation to the colours. There is no method so simple and so certain of revealing the photographic value of a colour filter as photography of the spectrum, and for this reason I put forward Mr. Tallent's spectroscopic camera as an instrument of the highest practical value. You have here at once the means of ascertaining all you want to know about the performance of your colour filters and plates, not only in regard to absorption of colour screens, and quality of illumination, but also the colour sensitiveness of your plates and the relative exposure required. Apart from this, almost every kind of spectroscopic studies may be performed upon this camera, and it is suggested that it should be exceedingly useful in any kind of testing where colour forms the basis of the test. In the filters made by Mr. H. O. Klein for Dr. Albert's Collodion Emulsion, the bands of absorption are arranged to co-operate with the insensitiveness of the plate for certain spectrum rays. For instance, if the violet filter should pass a little red it is unimportant, because the plate is insensitive to red, showing the undesirability of adhering too closely to visual tests with the spectroscope without taking into account the colour sensitiveness of the plate. By ignoring those parts of the spectrum which are not likely to affect the plate, even if they pass through the filter, we are able to make our filters very transparent, and thus reduce the exposures. The colour sensitising of the plate is a wide subject, which I cannot go into to-night, but I would just like to call your attention to the two newest sensitisers, titan-scarlet (for the red) and ethyl-violet (for the blue); both are powerful colour sensitisers, which greatly reduce the exposure.

Mr. J. A. C. Branfill was one of the earliest to suggest that all three colours might be introduced into the diaphragm at one time, by having three apertures, each covered with a film of coloured collodion. His idea was that the apertures should be in the ratio of the relative exposure values, though it would be possible, of course, to have them the same size, and reduce the colours to a common luminosity. A ruled screen has to be interposed in front of the plate, and the diaphragm photographed on the pinhole principle of half-tone. To produce the printing surfaces the negative was to be masked by another screen, which would successively cover up the set of dots or lines corresponding to each particular colour, so that the three separate plates could be obtained from the one negative first taken. This method has been actually realised in what is called the Brasseur-Sampolo process, so far as concerns the masking of a single negative to produce three plates from it, but they do not use the diaphragm idea. The composite negative is produced by a modification of the Joly screen. A much closer approximation to Mr. Branfill's idea formed the subject of a patent taken out by Szczepanik, who has also invented a method of applying the half-tone process to the making of cards for the Jacquard loom, and also has a patent for telegraphing pictures. [Two slides are shown which illustrate the Szczepanik modification of Branfill's idea. The diagram shows the usual half-tone projection lens, diaphragm, ruled screen, and plate. The next slide explains the diaphragm. Suppose you put this square diaphragm in the lens, and the screen is a single-line one, a diaphragm, such as here shown, would give black bands on the plate. If the screen is moved away from the plate, a position is reached where the light bands join up and form a continuous image.] Now, other things remaining the same, the substitution for the diaphragm of one of equal width, but one-third the height, will give an image broken into dark bands twice the width of the light bands. The successive use of the three diaphragms will permit the exposure of the whole of the plate in sections, and if these diaphragm openings are covered with colour filters, a negative is obtained representing the colour sensations very much as is the case with negatives taken through the Joly screen. A positive made from this negative is projected in the colours of the original by inserting a diaphragm containing equal stripes of the three primary colours. To make the matter plain, I have coloured the openings with the three filter colours—red, green, and violet. But if the inventor meant to imply by the letters "R. J. B.," that the openings were to be filled with red, yellow, and blue—expressed by the initials of the French words, *rouge, jaune, bleu*—he evidently did not know the principle of what he was trying to invent, for no practical three-colour worker would think of taking his negatives with the same filters as those used for projecting transparencies. Before closing, I would like to acknowledge my indebtedness to Mr. H. O. Klein for his assistance in preparing slides relating to the application of collodion emulsion to three-colour work; to Mr. Edgar Senior, of the Battersea Polytechnic, for his slides illustrating the three-colour process and the metzograph grain, and for the loan of an ingenious colour sensitometer [which I show therewith]. By its means the colour-sensitiveness of plates and the absorption of screens can be very readily and simply tested. Also I have to thank Mr. W. T. Wilkinson, of the Goldsmiths' Institute, for the slides illustrating the photogravure and metzograph grain, and some slides showing excellent enlargements of the half-tone dot.

William Gamble.

THE PLATINOTYPE PROCESS.

I.—THE CHEMICALS AND PAPERS.

IN 1894 Von Hübl published the most complete work on the platinotype process, and a second edition has just been issued,* which contains a notable addition in the shape of the author's researches on sepia printing, and a digest of the same may be of interest.

In the introduction the author divides the process into three kinds:—(1) That in which paper coated with ferric oxalate is exposed to light and then developed with a solution of a platinum salt and potassium oxalate; (2) here the platinum salt is added to the ferric oxalate and the paper sensitised with the mixture and the print developed, after exposure with solution of potassium oxalate; (3) the developer is mixed with the sensitiser, and it is only necessary to immerse the print in water after exposure in order to have a perfect result.

With regard to the first process, Hübl states that it is but rarely used, but that it deserves the fullest consideration, as it exceeds the two other processes in beauty of the results, and in the safety and ease of manipulation. The second process includes both the hot and cold bath processes, the former requiring a shorter exposure, and giving softer results than the latter, whilst the third is the print-out process.

Ferric oxalate is the principal light-sensitive salt, and this is used in the form of a 20 per cent. solution with 1 or 2 per cent. of oxalic, and this is called the "normal iron solution."

The usual method of preparing ferric oxalate is by precipitating ferric hydrate from ferric chloride by means of caustic or carbonate of soda, and digestion of the ferric hydrate with oxalic acid. This method necessitates, however, a quantitative analysis of the resultant solution, in order to ascertain the percentage of ferric oxalate. In order to avoid this, Weissenberger (Photo. Corresp. 1889, pp. 420, 609) suggested the use of ammonia iron alum dissolved in hot water, and precipitation with carbonate of soda, and Hübl still further improved this method of using ammonia and doing away with filtration.

Ammonia iron alum, $Fe_2K_2\ (SO_4)_4,\ 24H_2O$, is a commercial salt, and is a constant composition, and contains 11·62 per cent. of metallic iron. It must be kept in closed bottles, or it effloresces and the percentage of iron increases.

Ferric oxalate contains 29·78 per cent. of metallic iron, and there is therefore in 100 cc. of a 20 per cent. solution 5·96 or, in round figures, 6 g. of metallic iron, and the equivalent quantity of ammonia iron alum is 51·63 g., and to allow for a small loss 52 g. should be used.

To prepare this salt, Hübl recommends a tall cylindrical measure of about 7 cm. diameter and 25 cm. in height. This should be marked, by a strip of paper outside, at the level of 85ccm. In this measure 52 grammes of powdered ammonia iron alum should be placed, and 20 ccm. o fliq. ammoniæ fort. 880 and 20 ccm. of water poured on to it, and the mixture well stirred for several minutes. If there is no smell of ammonia, a few drops more of ammonia should now be added, and the mixture again well stirred. The measure should be now filled up with water, the precipitate well stirred or shaken up, and then left to settle. When it has settled down the water should be decanted or siphoned off, and the operation repeated till there is no longer any smell of ammonia, and it does not turn litmus paper blue.

It is important that the total bulk of the mixture should not exceed the level of the 85 ccm. mark. When it has reached this level 21· grammes

* "Der Platindruck." Arthur Freiherrn von Hübl. Hale a/S: William Knapp.

of pure oxalic acid should be added, and the mixture well stirred, and, if necessary, left to itself for a little time. A perfectly clear solution will be obtained, which will measure 95 ccm. This must be made up to 100 ccm. It is essential that the addition of the oxalic acid should be made by yellow light, and the resultant solution, which is a 20 per cent. solution of ferric oxalate, must not be exposed to daylight. The solution should be greenish-yellow when examined by daylight, and, on the addition of ferridcyanide of potash, should turn dark green, but give no blue precipitate.

Another salt which is useful is oxalate of lead, which may be obtained commercially, but can also be prepared by dissolving 20 g. of acetate of lead in 100 ccm. of water, heating gently and adding 4 g. of oxalic acid, collecting, washing, and drying the precipitate. One gramme of the lead oxalate should be added to every 100 ccm. of the iron solution, and the resultant mixture well shaken, filtered, and labelled "Lead-Iron Solution."

Sodium ferric-oxalate, $Fe_2(C_2O_4)_6Na_6 + 11H_2O$, it is advisable to buy. It should be in clear, green crystals, though if any adherent yellow powder is present it is not of much moment. Fifty grammes of this salt should be dissolved in 100 ccm. of water, and the solution filtered and be kept in the dark, and labelled "Soda-Iron Solution."

Two platinum salts are required, both of which can be obtained commercially, and which are not worth the trouble of preparing.

Potassium chloroplatinite, K_2PtCl_4, occurs in red crystals, which are readily soluble in water, and a stock solution of 1 to 6 of distilled water should be prepared, and kept in the dark.

Sodium platinic chloride, $Na_2PtCl_6 + 6H_2O$, occurs in yellow prisms, and when heated to 100 deg. C. loses its water of crystallisation, and becomes a yellow powder, one part of which dissolved in 10 parts of distilled water forms the stock solution. In order to avoid the trouble of heating, practically one-fourth more of the hydrated salt may be used instead, that is to say, 12·5 parts instead of 10 parts.

Hübl points out that the chemical reactions in platinotype printing have been represented by Berkeley as follows:—

During exposure:

$$(Fe_2(C_2O_4)_3 = 2FeC_2O_4 + 2CO_2$$

and during development:

$$(6FeC_2O_4 + 3K_2PtCl_4 = 2Fe_2(3_2O_4) + Fe_2Cl_6 + 6K\,Cl + 3Pt.$$

But, from arguments which we need hardly recapitulate, he comes to the conclusion that formic acid is formed, and that this plays a considerable part in the reduction of the platinum salts, especially during development.

Considerable importance is laid by Hübl on the raw paper used, and he points out that its surface has considerable influence on the results, as the image is not embedded in any colloidal vehicle. The colour of the paper is seldom pure white, being generally blue or yellow. The former gives bright, clear, high lights, whilst the latter gives softer effects. For small prints with smooth surface the blue-tinted papers are better, whilst for large prints the yellow tint is to be preferred. So that the prints should not turn yellow afterwards, pure linen papers should be used. The sizing of the paper is of importance, too, and those papers sized with resin are the best. All papers are improved by a sizing preliminary to sensitising. Gelatine, arrowroot, carragheen, tragacanth, Agar-Agar, etc., may be used. Gum arabic and dextrine cannot be used, because they are soluble in water, and would dissolve in the developer.

Gelatine has the disadvantage of causing numerous bubbles whilst sensitising, and also it tenaciously retains traces of platinum salts, so that the prints on paper thus sized have a tendency to yellow in time. It further gives a slightly-glazed surface.

Arrowroot, carragheen, and tragacanth are very satisfactory, and always give matt surfaces. Agar-Agar combines the good qualities of arrowroot and gelatine. To prepare the preliminary coating with these substances, 10 parts of each should be used to every 500 or 1,000 parts of water. They should be allowed to swell for an hour, and be then dissolved. To the gelatine solution five parts of powdered alum should be added, and the mixture must be used warm. Arrowroot must be mixed with cold water and added to boiling water and stirred till a clear solution is obtained. For Agar-Agar five parts should be soaked for an hour in 500 parts of cold water, boiled for five minutes, and then filtered through fine muslin, and then allowed to cool, and the jelly thus obtained pressed two or three times through coarse linen, and the resultant finely-divided mass distributed over the paper with a brush.

The following are the papers specially recommended:—Smooth Rives and Steinbach paper, No. 27 of the Neusiedler Actiengesellschaft für Papierfabrikation in Vienna, the roll papers of Schleicher and Schull of Düren.

The English drawing-papers by Whatman and Harding have a very good grain, but are, unfortunately, animal (gelatine) sized, and this must be removed. To effect this the paper should be placed in a dish of hot water to which some sulphuric acid has been added, and after about an hour the water must be poured away and the paper washed with repeated changes of water, to which, finally, some ammonia should be added. It must then be pressed between blotting paper to dry, and subsequently sized with a 1 per cent. solution of Agar-Agar, applied hot and liberally with a brush, and then dried, again treated with the solution, dried, and then with a 2 per cent. solution of arrowroot.

II.—The Cold Bath Process.

The necessary solutions for this process have already been described, with one exception, and that is the oxalic-gelatine solution; this is prepared by soaking 2 grammes of gelatine in 20 ccm. of water, adding ½ gramme of oxalic acid and heating. After this treatment the gelatine solution remains fluid, but the solution will not keep more than a few days. Hübl recommends three stock solutions:—

I.

Chloroplatinite solution	3 ccm.
Lead-iron solution	4·5 ccm.

II.

Chloroplatinite solution	3 ccm.
Lead-iron solution	4·5 ccm.
Oxalic gelatine solution	1 ccm.

III.

Chloroplatinite solution	3 ccm.
Lead-iron solution	3 ccm.
Soda-iron solution	ccm.

For smooth papers from 2 to 3 ccm. of water should be added, and for rough from 3 to 8 ccm. These quantities are enough for a sheet 50 by 75 cm.

All these formulæ give rather soft prints; if, therefore, prints with greater contrasts are required, from 5 to 10 drops of the 10 per cent.

solution of sodium platinic chloride should be added. Solution No. I. will keep for a month in the dark, and gives with arrowroot sized and Rives paper brownish black tones, on drawing and water-colour papers pure black tones, and on Rives paper with gelatine sizing blue-black prints. By coating Rives paper with arrowroot and using solution No. II. blue-black prints are obtained. For very hard negatives solution No. III. should be used.

The particular method of sensitising and drying will be described later on.

THE HOT BATH PROCESS.

For brownish black tones on arrowroot paper and pure black prints on drawing paper, which has been freed from animal size and re-sized with Agar-Agar, as already described, the following solution should be used:—

Chloroplatinite solution	4 ccm.
Iron solution	5 ccm.

For smooth papers add from 2 to 2 ccm. of water; for rough papers from 3 to 4 ccm. of water.

For blue-black tones on gelatine-sized papers, use the following:—

Chloroplatinite solution	4 ccm.
Iron solution	6 ccm.
Oxalic-gelatine	1 ccm.

Dilute as suggested above.

In order to increase the keeping power of the paper, add to the sensitising solutions 1 or 2 drops of sodium platinic chloride solution. These sensitisers give soft prints; for more contrast add from 5 to 10 drops of a 10 per cent. solution of potassium bichromate.

THE SEPIA COLD BATH PROCESS.

For this process it is advisable to use only those papers sized with Agar-Agar, as already described, as it is easier to obtain brown tones than with arrowroot.

Yet another chemical is required, namely, citrate of mercury, and this is prepared by heating together 1 gramme of yellow oxide of mercury, 5 grammes of citric acid, and 20 ccm. of water till the solution is quite clear, when it should be filtered. The sensitising solution is:—

Iron solution	8 ccm.
Chloroplatinite solution	4 ccm.
Mercuric citrate solution	1-4 ccm.
Sodium platinic chloride solution	2 drops.

For rough surface papers add from 2 to 4 ccm. of water. If greater brilliancy is required, the quantity of sodium platinic chloride may be increased to 5 drops.

THE SEPIA HOT BATH PROCESS.

For this process either Agar-Agar or arrowroot papers can be used, and the following solutions:—

Chloroplatinite solution	4 ccm.
Iron solution	6 ccm.
Mercuric chloride solution (1:20)	0 2-1 ccm.
Sodium platinic chloride solution	2 drops.

For rough papers add from 2 to 4 ccm. of water, and for greater brilliancy increase the sodium platinic chloride to from 5 to 10 drops.

IRON PAPER WITH PLATINUM DEVELOPER.

Although historical notes have been entirely omitted in this digest, it is but fair to point out that to Mr. W. Willis is due the introduction of the platinotype process, and this one in particular was described by him in

1888,* and he then advanced as the advantages of the process the greater keeping power of the paper, the greater brilliancy of the whites, and depth of the shadows, and further, that the prints could be kept some days before development.

Hübl's formulæ for sensitising are as follow:—

I.

Lead iron solution	5 ccm.
Mercuric chloride solution (1:20)	0·2 ccm.

II.

Lead iron solution	5 ccm.
Chloroplatinite solution	0·5 ccm.

III.

Lead iron solution	5 ccm.
Chloroplatinite solution	0·3 ccm.
Sodium platinic chloride solution	0·4 ccm.

IV.

Lead iron solution	5 ccm.
Chloroplatinite solution	0·8 ccm.

All the above will keep well, but the chloroplatinite must be added just before use, and they should be diluted with from 3 to 6 ccm. of water. No. IV. is specially suitable for small soft negatives and portraits.

For line drawings, for which purpose it has been used for many years in the K.u.K. Militär-Geographischen Institut in Vienna, the following may be used:—

Lead iron solution	200 ccm
Chloroplatinite solution	10 ccm.
Potassium chromate solution	10 ccm.
Water	200 ccm.

This is sufficient for 27 sheets 66 by 90 cm., but as the solution keeps well, it can be prepared in any quantity.

Hübl points out that this process is cheaper than any silver process for line work, the consumption of platinum being only 0·2 gramme per sheet, and that a cheaper paper can be used than for silver paper, as it need not be absolutely free from iron.

Print-out Platinum Paper.

This process was discovered by Pizzighelli in 1887, and the sensitised paper actually contains the developer. If the paper is prepared with arrowroot, Agar-Agar, or Carragheen, the following may be used:—

Chloroplatinite solution	4 ccm.
Soda iron solution	6 ccm.

This may be diluted for rough surface papers with from 2 to 3 ccm. of water.

In order to do away with the preliminary sizing, gum arabic in the sensitiser, thus:—

Chloroplatinite solution	4 ccm.
Soda iron solution	6 ccm.
Gum arabic solution (1 : 2)	4 ccm.

For thin negatives from 3 to 10 drops of sodium platinic chloride or 1 per cent. bichromate of potash solution may be added.

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* "Photo Journal," March, 1888.

III.

PRINT-OUT SEPIA PAPER.

Sepia tones may be obtained by this process either by the use of palladium or mercury salts, but the former require absolute dryness and the use of a photometer whilst printing, and there is a great tendency for the shadows to be brown and the half-tones grey.

The sensitiser with palladium is:—

Chloroplatinite solution	4 ccm.
Soda iron solution	6 ccm.
Chloropalladinite of potash solution (1 : 10)	2 ccm.

The paper should be sized with arrowroot.

For the mercury process (3) solutions are required:—

I.

Chloroplatinite solution ....

II.

Sodium ferric oxalate	40 g.
Gum arabic (powdered)	40 g.
Sodium oxalate solution (3 per cent.)	100 ccm.
Glycerine	3 ccm.

A few drops of sodium platinic chloride, or 1 per cent. bichromate solution, should be added to every 10 ccm. The sodium oxalate solution should be heated to 40deg. or 50deg. C., then the ferric oxalate and glycerine added, and the warm solution added to the powdered gum in a mortar with continual rubbing, and then the mixture filtered through a clean cloth into a wide-mouth bottle. It is advisable to add a few drops of a 1 per cent. solution of potassium chromate, or 10 per cent. solution of sodium platinic chloride solution to every 100 ccm. of this mixture.

SENSITISING THE PAPER.

A great deal of the success in the home preparation of platinotype paper is dependent on the operations of sensitising and drying the paper; one of the most important points is freedom from dust during drying and also freedom from anything like the products of burning gas.

For measuring the small quantities of liquids required, pipettes are better than the ordinary measures. In most of the formulæ will be found the term "drops." These should be calculated as 20 drops being equal to 1 cubic centimetre; and they can be conveniently measured by obtaining a piece of feeding-bottle glass tube drawing to a fairly fine point, and closing the other end with a blind teat. A trial with various-sized holes in the glass will soon give one that will deliver the correct sized drop, or of course they can be measured in a finely-divided 1 ccm. pipette.

Another and most important point is the light in the room whilst sensitising, and in fact when mixing the solutions, for it must not be overlooked that they are in themselves sensitive to light. A bright gas light or even diffused daylight is quite sufficient to cause enough fog to give degraded high lights, so that it is advisable to use a yellow medium to filter the light, and even through this bright sunlight will cause fog.

In all cases the sensitising solutions must be distributed with brushes, but these must not be bound with metal, which would reduce the sensitising solutions, and give rise to endless trouble in the shape of black markings; nor must the brushes be too soft, otherwise they will absorb too much of the sensitiser; nor too hard, in that they will then cause streaks. For small sheets a round hog's hair glue brush, bound with string, can be used, whilst for large sheets a brush somewhat similar to a nailbrush with a handle on top is more convenient. It is also advisable to have a soft long-haired flat brush, which serves to even out any possible brush-marks.

The paper should be fastened by drawing-pins to a flat board, but care must be taken not to touch these whilst sensitising. The necessary quantity of sensitiser should be poured on to the middle of the paper, and rapidly distributed with the round brush, and if rapidly and lightly done first along the length and then across the breadth there will be no need for using the flat distributing brush, this latter being specially useful for large sheets; on the slightest sign of any dry places, the brush must be laid aside, for if the brush be used over such places, it causes streaky marks. Sensitisers containing sodium ferric oxalate must be lightly rubbed, preferably with circular strokes, with the flat distributing brush till all sign of glaze from the liquid is seen, otherwise crystals form on the surface. The distributing brush must also be used with all sensitisers containing gum or gelatine, as with these solutions innumerable small bubbles are formed, which, if allowed to dry, cause white or light spots, therefore the distributing brush must be used till the surface is dry.

It may be noted here that Hübl has proved that the sensitising solutions will keep for months in the dark.

Drying the Papers.

It may be taken as a general rule that artificial heat is absolutely necessary to dry platinotype papers, except in exceedingly dry and warm climates, and it is also advisable not to use a room too cool for sensitising. For drying a normal heat is 50 deg. to 60 deg. C.; at the same time it must be noted that from one-half to one hour is sufficient to ensure perfect dryness.

In sensitising for the cold bath process, the paper should be left for 10 minutes before being subjected to artificial heat, and in the print-out process artificial heat is unnecessary, except in very cold and wet weather.

Printing, Developing, etc.

Little need be said as regards the printing of platinotypes, as this is fairly well known, except to lay stress upon one or two points. It is well known, of course, that damp has considerable influence on the result, and indeed it causes loss of sensitiveness, fogginess, and want of depth in the shadows; it is, therefore, necesary to keep the paper as dry as possible whilst printing, especially in the winter or autumn, or when there is a good deal of moisture in the air, and therefore the negative should be well dried and preferably varnished, and the pads of the printing-frame be india-rubber.

It is advisable to use a photometer, and one made of fairly transparent paper is preferable, with gelatino or collodio-chloride paper, and it must not be forgotten that platinotype paper is from twice to four times as sensitive as the silver papers. Hübl strongly advises a trial printing with a small strip of the paper under a typical part of the negative, because the spectral sensitiveness of the silver papers is not quite the same as that of the platinotype, the former being more sensitive to the violet, the latter to the blue. For this reason, too, he strongly recommends a particular make of photometer consisting of 10 scales, half being covered with yellow glass, which cuts off the violet and transmits only the blue. It is obvious from this that yellow negatives will give more brilliant platinotype prints if covered with a blueish glass, and that blue-black negatives should be covered with a yellow glass, so as to limit the active light to the blue and blue-green rays. Bright sunlight gives also flatter prints than diffused light. A statement has been made that green glass over the negative gives more brilliant prints; but this is only correct for a given colour of negative and particular colour of glass.

The cold bath paper requires printing out to nearly full depth, and with this, and with all the papers in fact, too bright a light should not be used whilst devloping. The developer may be a 1 : 3 or 1 : 5 solution of potassium oxalate, and the solution must be neutral; or a better developer still is Willis' phospho-oxalate solution:—

Neutral potassium oxalate	100 parts.
Potassium phosphate	50 parts.
Distilled water	1,000 parts.

The print should be immersed face downwards, drawn through the developer, and turned over and left, or placed on a sheet of glass, face upwards, till full depth is obtained, and then transferred to the acid bath. For large prints it is preferable to place them face upwards on a sheet of glass, and devolop them with a brush and a developer containing one-sixth of its volume of pure glycerine, the use of which prevents any lines showing.

If the prints are over-exposed or greater brilliancy is required, the developer may be diluted with from four to six times the quantity of water, or, what is better still, add from two to five per cent. of a one per cent. solution of potassium bichromate. Willis suggested the use of ·1 to ·3 of potassium nitrite, and Von Janko the addition of ·5 to 1 per cent. of ammonium persulphate.

For the hot bath paper the same developers, made acid, may be used, but heated to from 50deg. to 75deg. C. The lower the temperature of the developer, the slower the print develops, and the hotter the developer the quicker it develops, so that the former may be used for over-exposure, and the latter for under-exposure. This paper does not want printing so much as the cold bath; in fact, the delicate half tone should not be visible.

The iron paper with platinum in the developer can be best treated in small sizes by floating on a small quantity of developer in a dish; for large prints this becomes somewhat expensive, and therefore brush development can be used, but there is considerable danger of brush-marks, unless glycerine be used in the developer, and this causes somewhat harder prints, and in fact requires that the paper should be exposed longer, as it prevents the appearance of the finer details.

The normal developer is:—

Chloroplatinite solution	1 ccm.
Phospho-oxalate developer	8-12 ccm.

That with glycerine is:—

Chloroplatinite solution	1 ccm.
Phospho-oxalate developer	8 ccm.
Glycerine	2-4 ccm.

About 20 ccm. are required for a sheet 50 by 60 cm.

For line work with this process the best developer is:—

Potassium oxalate (sat. sol.)	450 ccm.
Chloroplatinite solution	12 ccm.
Glycerine	50 ccm.

and 30 ccm. are sufficient for a sheet 66 by 90 cm.

For the print-out process it is necessary that the paper be damp if the image is to print right out in the printing frame, but if it is too damp it may actually spoil before the details are impressed. The best way is to pin the sheet face downwards to the lid of a box, and place over a dish filled with water at 40deg. C. for from one and a-half to two and a-half minutes, the older the paper the longer the time.

The developer for the cold bath, sepia paper, should be acidified with 10 per cent. of oxalic acid, and the phosphate developer is preferable.

For the hot bath, sepia paper, the following is the best developer, and it should be heated to 70deg. C.:

Potassium oxalate	100 parts.
Potassium phosphate	50 parts.
Citric acid	20 parts.
Potassium chloride	10 parts.
Water	1,000 parts.

For sepia paper, Mr. Charles F. Inston recently suggested the following developer:—

Potassium oxalate	62 g.
Mercuric chloride	6 g.
Potassium citrate	10 g.
Citric acid	16 g.
Water	450 ccm.

For use this is mixed with an equal quantity of water. As an improvement on this, which throws down a heavy precipitate, he now suggests two solutions:—

I.

Potassium oxalate	142 g.
Water	1,000 ccm.

II.

Potassium citrate	22·2 g.
Citric acid	35·7 g.
Mercuric chloride	13·4 g.
Water	1,000 ccm.

For use mix in equal parts. The print must be printed deeper than usual.

Notwithstanding the fact that a sepia platinotype paper can be obtained commercially, a peculiar perversity, exemplified with other processes also, has induced some experimenters to obtain sepia tones with the ordinary black platinotype papers, Mr. Peebles Smith (Amer. Am. Phot. 1897) suggested developing the cold bath paper with the following developer, for which four stock solutions are required:—

I.

Potassium oxalate	250 g.
Distilled water	1,000 ccm.

II.

Cupric chloride	31 g.
Distilled water	1,000 ccm.

III.

Mercuric chloride	62·5 g.
Distilled water	1,000 ccm.

IV.

Lead acetate	16 g.
Distilled water	1,000 ccm.

For use mix 3 parts of No. 1 and 1 part of No. 2, then add, with vigorous shaking or stirring, 1 part of No. 3, and finally a fourth part of No. 4. Filter if necessary, and heat to from 80 to 85deg. C. The prints are developed and fixed in the usual way. Increase of the proportion of mercury will give warmer tones, and other variations may be obtained by substituting sodium acetate or phosphate for the oxalate.

For fixing, as is well known, three acid baths are used, and the first should be a 2 per cent. solution of hydrochloric acid, in which the print should be left for five minutes, and then it should be transferred to a somewhat weaker bath for 15 minutes, and thence into the third bath, and then well washed. It is advisable to neutralise the last traces with about a ·2 per cent. of washing soda, but this should not be used till after the prints have been washed a little time. It is not advisable to wash platinotypes too long, and three or four changes in from one-half to one hour is quite enough.

IV.

After Treatment of the Prints.

Although the after treatment of platinum prints is fairly well known, I have thought it worth while to abstract what Hubl has to say on the subject, and add a note on those processes which he does not mention.

In the first place, it is not possible to reduce a platinotype print, platinum, even in a finely divided state, being extremely resistant against the ordinary reducing agents. They can, on the other hand, be intensified and "toned" to various colours; in all cases the so-called toning is more or less of an intensification process, and this must not be forgotten, so that prints for these processes must not be developed quite so far as usual. The prints must be, of course, thoroughly freed from all iron salts, and it is immaterial whether the prints are freshly made, though some old prints seem to be less inclined to take kindly to one or other of the processes.

Lyonel Clark suggested the use of an acid pyro-silver intensifier, but Hubl states that he has never been able to obtain satisfactory results, and that the deposit is generally coarse-grained. The formula is:—

Glacial acetic acid	50-60 drops.
Pyrogallol	0·65 g.
Distilled water	360 ccm.
Silver nitrate solution, 12 p.c.	20 drops.

The silver solution must be added gradually and it is advisable to flood the print first with the acid pyro and then add the silver in successive portions to the solution as the intensification is more under control. Hydroquinone may be used instead of pyro in the above formula and the action is slower. Of course, the silver on the image can be toned with gold or platinum.

The most satisfactory method is certainly the intensification with platinum, and there are three ways of doing this, the first two, however, are extremely liable to give coarse-grained prints, and there is the further disadvantage that the intensifier becomes thick and black, and this occurs so suddenly that frequently the platinum is precipitated in the paper.

Dr. E. Vogel's intensifier is:—

Chloroplatinite solution	3-5 drops.
Ferrous oxalate developer	5 ccm.
Distilled water	50 ccm.

This is applied to the prints after the acid baths.

Dr. A. Miethe's process is to apply the intensifier to the print before fixation, so that the platinum salt of the paper is used:—

Potassium oxalate solution (3·10)	125 ccm.
Ferrous sulphate solution (3·10)	25 ccm.
Potassium bromide solution (1·10)	25 drops.

The print is placed face upwards in a dish and a little of the above solution poured over it and when sufficiently intensified, it should be treated with the acid baths.

The third, and the only satisfactory method, is that with sodium formate suggested by Hubl, and it is, of course, purely a physical intensification, the platinum being deposited *in statu nascendi* upon the image; the intensification is slow, taking about 15 minutes in all, and is, therefore, well under control. Two stock solutions are required, which keep well.

I.

Sodium formate	10 g.
Distilled water	100 ccm.

II.

Platinum bichloride	2 g.
Distilled water	100 ccm.

For use mix from 100 to 200 ccm. of water with 5 ccm. of No. 1 and then 5 ccm. of No. 2. It will be noted that here the chloroplatinite is not used. The solution for use must be mixed as stated, and if the two stock solutions are mixed together first and then the water added, there is a great tendency for them to turn black before sufficient intensification is obtained. The prints should be well washed after the acid bath before intensification.

Another method, and one which is useful to give a better colour to somewhat rusty-looking prints, and at the same time as intensification, is Mr. A. W. Dollond's process with chloride of gold; there is, however, great tendency for the whites to turn pink. The well-washed print should be placed face-upwards on a sheet of glass and blotted off with blotting paper, and covered, by the aid of a brush, with pure glycerine, then a few drops of a 3 per cent. solution of chloride of gold should be dropped on the print and rapidly brushed over it; when the desired intensification is obtained, the print should be well washed and then sponged back and front with a metol potash developer, and again washed and dried.

In the so-called toning process, there is, as has already been mentioned, intensification and the platinum image undergoes no change in itself, but merely acts as convenient points for the deposition of the toning compound.

For uranium toning three stock solutions are required:—

I.

Uranium nitrate	10 g.
Glacial acetic acid	10 ccm.
Distilled water	100 ccm.

II.

Red prussiate of potash	10 g.
Distilled water	100 ccm.

III.

Ammonium sulphocyanide	50 g.
Distilled water	100 ccm.

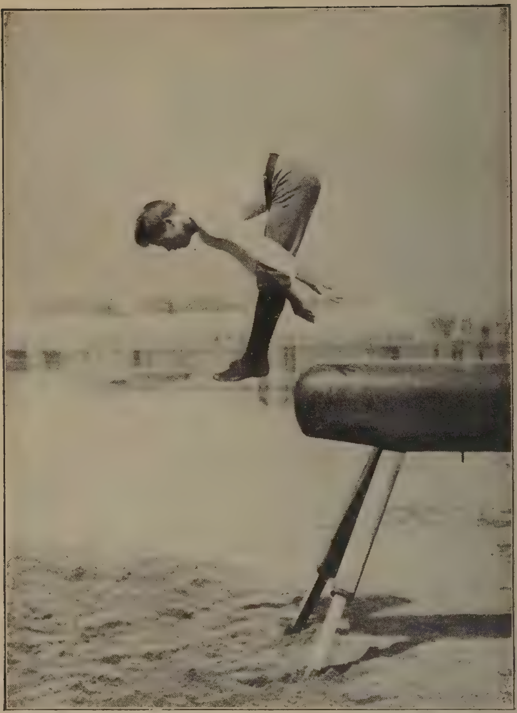
For use add to the litre of water 10 cc. of No. 1, and then 10 ccm. of No. 2, and finally 10 ccm. of No. 3. A 10 per cent. solution of

" RIGOLEUR."

By John H. Gear, F.R.P.S.

Taken with the

Goerz Double Anastigmat.



THE GYMNAST.

Taken in $\frac{1}{1000}$th second with the

Goerz-Anschutz Folding Camera

. and .

Goerz Double Anastigmat.

ORANGE CAMERA CLUB.

sulphite of soda may be used instead of the sulphocyanide, and in this case 5 ccm. of each solution may be added in the same way. When the desired tone is reached the prints should be washed in acidulated water and then dried. It is important that the toning solution should keep clear, otherwise the whites of the prints will suffer.

For bluish tones the following can be used:—

I.

Ammonia iron alum	10 g.
Hydrochloric acid	10 ccm.
Distilled water	100 ccm.

II.

Red prussiate solution, as above.

III.

Sulphocyanide solution, as above.

For use 5 ccm. of No. 1, 2 ccm. of No. 2, and 5 ccm. of No. 3 should be added in turn to the like of water.

It is hardly necessary to say that for anyone desirous of practical work in the manufacture of platinotype paper a careful study of Hubl's work is absolutely essential, for there are numerous important points which I have necessarily had to omit in this bare digest.

MOLECULAR STRAIN THEORY OF VISION AND OF PHOTOGRAPHIC ACTION.

(A Paper read before the Royal Photographic Society.)

I.

CONTENTS.

Introduction—Object of present inquiry—Molecular changes produced in matter by invisible electric radiation—Physico-chemical changes produced in a strained substance—Methods of detecting molecular changes—Method of conductivity variation—Mechanical model—Effect of molecular friction—Transient and permanent after-effects of radiation—Relapse of invisible image—Phenomena of reversal—Artificial retina—Electric theory of vision—Retinal current—Effect of light of short duration—After-oscillation—Binocular alteration of vision—Visual impression of lightning—Vital response—Response in ordinary plants—Vitalism—Inorganic response—Response to mechanical and light stimulus—Photographic applications—Effect of annealing—Effect of stimulants and depressors—Relation between stimulus and molecular effect—Effect of superposition—Effect of intermittence in modifying the law of photo-chemical action—Photographic effect modified by the time rate—Phenomenon of reversal—Arrestors—Conclusion.

INTRODUCTION.

Nature has been arbitrarily divided into the artificial classification of the sciences. But one science imperceptibly merges into another, and in the borderland there is no sharp line of demarcation. We shall, this evening, have to enter a region where three kingdoms meet—physics, chemistry, and physiology. If we wish to see things rightly we must place ourselves so as to survey the range of phenomena as a whole.

As an example of the difficulty of including any particular group of phenomena within an artificial classification, let us take the subject of the formation of latent images, which for convenience is known as photography. These images are by no means formed by the exclusive agency of the stimulus of light, but they are also formed by the stimulus of cathode discharge by the Röntgen rays, by the chemical stimulation of emanations from various active bodies such as radium or uranium, also by electric and mechanical stress. Note in connection with this that the visual effect may be produced not by light alone, but by the mechanical stimulus of a blow, or the stimulus of an electric shock. Even when we confine our attention to the action of light—that is to say, of ether waves—we find that the images are formed not only on plates made of sensitive silver compounds, but on plates of pure silver and gold. Some impression of a molecular change—which may hardly be called chemical—has in these latter cases been impressed by ethereal disturbance. The impress of molecular changes are produced not only by visible light, but also by invisible light in the ultra-violet region. We have light again at the other end of the scale, in the region of electric radiation. Do these long ether waves produce no change in matter? You have heard a great deal lately of messages sent through space without connecting wires. It would perhaps cause surprise to you that in virtue of your charter you may claim that achievement as your own. The vastness of the photographic empire has not yet been fully realised. The electric wave which carries the message is known to be invisible light. I hope to demonstrate the fact that the detector by which the message is received—the coherer so called—is nothing more than a linear photographic plate.

OBJECT OF THE PRESENT INQUIRY.

With reference to photographic action, various facts are known which cannot be well explained from purely chemical considerations. It will be shown that when a substance is molecularly strained, its chemical activity is modified in consequence of the physical strain. The acted and unacted portions will therefore be unequally attacked by a developer. In the case of a compound the strain produced may cause a modification which renders it susceptible to decomposition by the action of a reducing agent. The observed evolution of chlorine when moist AgCl is exposed to the long continued action of intense light is often adduced in support of the chemical nature of photographic action. This extreme case of dissociation cannot, however, be regarded as representative of the action of light in the formation of latent images. In ordinary photographic action we have merely the effect of a moderate stress producing the corresponding strain (with concomitant variation of chemical activity), and not the disruptive effect of a breaking stress.

We have seen that the latent image is formed not only on sensitive plates, but even on inactive sheets of metal; that these impressions are formed not only by the stimulus of ether waves, but also by mechanical stimulus. If we wish then to obtain an understanding of the phenomenon at all adequate, we have to detect and trace the molecular changes produced in matter by the action of different forms of stimuli.

In the case of action of radiation, we have to find means for measuring the minute changes produced on the extremely thin surface layer. It is preferable to begin with the study of radiation effect on some elementary substances, thus avoiding secondary complications. It is also necessary to be able to follow all the stages of the change. I shall briefly describe how these ideal requirements may be realised by the use of conductivity and electro-motive variation methods, which not only enable us to detect extremely minute molecular changes, but also to follow these moment after moment in a continuous manner.

I have to describe the molecular effects produced on matter by the action of invisible electric radiation, and will then show how these effects may be graphically recorded by means of "response curves" obtained by the method of conductivity variation. I will next explain how by the use of electro-motive variation methods the molecular effects produced by mechanical stimulus or by visible light may also be exhibited in the form of response curves.

It will be shown that pursuing diverse modes of inquiry, concerning the action of various "molecular receivers," we are led to a great generalisation on molecular stress and strain. We shall find that the effects of stimulus in the retina, in the photographic plate and in the coherers so-called, are but particular expressions of molecular response. The conclusions arrived at are not merely theoretical; they necessarily follow from the experimental results which I have obtained, some of which will be presently described, and will offer a simple explanation of various obscure phenomena of photographic action, such as the relapse of the invisible image, recurrent reversals, dependence of photographic effect on the time rate and others.

Molecular Changes Produced in Matter by Electric Radiation.

The effect of electric waves on a mass of metallic particles is often to produce a diminution of electric resistance. It used to be thought that electric disturbance produced minute induction sparks which caused the welding of particles, hence the diminution of resistance. From this theory of coherence it follows that the diminution of resistance should take place in all conducting particles, and that the diminution should be permanent; in other words, the effect should be non-discriminative, and there should be no self-recovery. In carrying out a systematic investigation on the effect of electric radiation on all elementary substances and a large number of compounds, I found, however, that instead of the action being non-discriminative, two opposite effects are produced; in the positive class of substance the effect of radiation is a diminution of resistance, whereas in the negative class the effect is an increase. Further, the conductivity variation is in several cases not permanent; such substances quickly recover and attain their original conductivity on the cessation of radiation, as if a force of restitution were called forth to restore them to their original condition. Again, if the substance is subjected to the continued action of radiation, the conductivity variation reaches a maximum value, which depends on the intensity of radiation. On the cessation of radiation there is an immediate recovery. The state of balance between the conductivity distortion produced by radiation and the force of restitution on one hand, and the different equilibrium positions with different radiation intensities on the other, point to the effect being due to some strain produced by radiation. The conductivity variation takes place even in platinum immersed in naphtha. It is evident that the effect is due, primarily, to some physical change.

Physico-Chemical Changes Produced in a Strained Substance.

If a substance be molecularly distorted by the action of an external agent, we may naturally expect that there would be produced changes in the physico-chemical properties of the substance. As a familiar example, take the case of phosphorus molecularly changed from the yellow to the red variety by the action of visible radiation. We find that in the allotropically modified condition the red phosphorus has become less active chemically, insoluble in CS_2, and of higher specific gravity. Similarly, in other properties, such as its elasticity, its position in the voltaic series, its electric conductivity, are likely to undergo a corresponding modification. The same molecular change seen from different aspects will appear to be diverse. Looking from an electric point of view, we do find that the conductivity of red phosphorus is different from that of the yellow variety. We thus see the possibility of measuring the molecular change by measuring the correlated variation of any of the properties described above. The choice of a particular method will be governed by special convenience under given conditions. We may thus use the following methods for detection of strain effects:—

(1) Method depending on the variation of adhesive power; *e.g.*, in the daguerreotype plate the mercury vapour adheres in preference to the light impressed portions only. Images may similarly be developed by water vapour.
(2) Method depending on the variation of chemical activity undergone by a strained substance or the method of photographic development. The acted and unacted portions are differently attacked by the developer. The action is not altogether independent of the effect described below.
(3) Method depending on the variation of electric potential by which an E.M.F. is produced between the acted and unacted portions of a substance originally isoelectric. On making suitable electrolytic connections, a galvanometer indicates a current originated by the differential action of the stimulus, the intensity of the current giving a measure of the molecular effect produced.
(4) Method depending on the conductivity variation produced by the strain.

The first two methods are well known to you. Here I have an experiment which is highly sensitive. A strain image was produced by laying a stencil on a photographic plate and electrifying the stencil. It has been subsequently developed. I placed the same stencil on a clean sheet of glass—note that here we have no sensitive salt, nothing but the chemically inactive sheet of glass. There is no visible change on the glass; you can detect nothing even under a miscroscope. But breathe over the plate, and the latent image comes out absolutely the same in all details as the image obtained on the photographic plate.

For the purpose of investigation of the changes induced by stimulus, the method of development is not satisfactory, inasmuch as the final effect alone is here detected. We miss the most important preliminary stages by which the ultimate result is brought about. It is necessary to have some means of studying all the stages of change in a continuous manner, so that the important preliminary phase of "molecular negotiation" may not be missed. The above ideal requirement may be realised as said before by taking advantage of the conductivity or electro-motive variation methods.

Method of Conductivity Variation.

It is often forgotten that the conductivity of a substance does not depend solely on the chemical nature of the substance; the state of molecular aggregation also plays an important part in determining the conductivity. As an illustration, take the case of carbon, which exhibits wide differences of conductivity in the two allotropic states of graphite and diamond. Suppose a piece of carbon in an intermediate state between diamond and graphite, and suppose an external force distorts it to a small extent towards the more conducting graphite state (that this supposition is not purely hypothetical will be seen from Crooke's experiment of conversion of diamond into graphite by the stimulus cathode discharge). This distortion would be attended with an increase of conductivity, from which latter the extent of distortion may be inferred. Now, during the distortion from equilibrium position, a force of restitution will tend to restore the substance to its original neutral condition. If the distortion does not proceed beyond the elastic limit, then on the cessation of the distorting force the substance will recover its original state, and this will be evidenced by the restoration of its original conductivity. But if the distortion is of a sub-permanent type, then mechanical vibration or heat may hasten the recovery of the substance.

MECHANICAL MODEL.

Here is a model (Fig. 1) of the sensitive substance with its three main conducting aspects—the diamond or non-conducting aspect, the intermediate or semi-conducting aspect, and, lastly, graphite or conducting aspect. Let it be interposed in an electric circuit, with an interposed galvanometer. If the stimulus of radiation distorts it to a more conducting state, the increased galvanometer deflection will show it, but if the distortion is in the opposite direction, there will be a diminution of current. We have thus a representation of effect exhibited by two classes of substance—positive and negative. In the former radiation produces a diminution, and in the latter an increase of resistance. If the substance is self-recovering, then the conductivity radiation will be transient—on the cessation of disturbance, the recovery will be shown by the galvanometer spot creeping back to its original position. The galvanometer needle thus moves in perfect response to the varying strain produced in the sensitive substance by the action of stimulus. The invisible molecular distortions are revealed by the visible deflections of the galvanometer needle. Curves of molecular effect, due to the action of radiation, may thus be obtained with the galvanometer deflection as ordinate and the time of exposure (or recovery) as abscissa. The rising part of the curve represents the effect of stimulus, and the falling part,

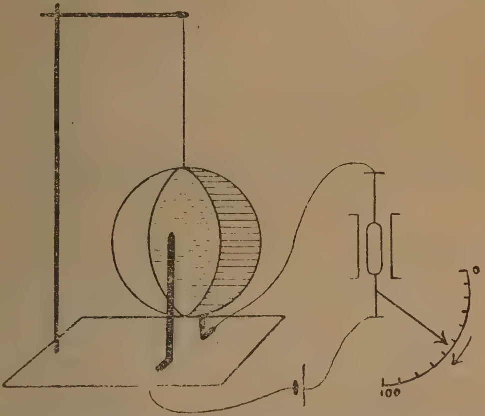


Fig. 1.—Model to explain the conductivity variation produced by molecular distortion. The three main conducting aspects are represented by different shadings.

the recovery. It is thus seen that these curves faithfully represent the invisible molecular strain effect due to the stimulus, and the after-recovery from the strain.

The curve of response, depending as it does on the molecular distortion and recovery from the strained condition, will be modified by an important factor—that of molecular friction. The second mechanical model will give us an insight into some of the most obscure response phenomena, not only in the realm of the inorganic, but also in the world of the living.

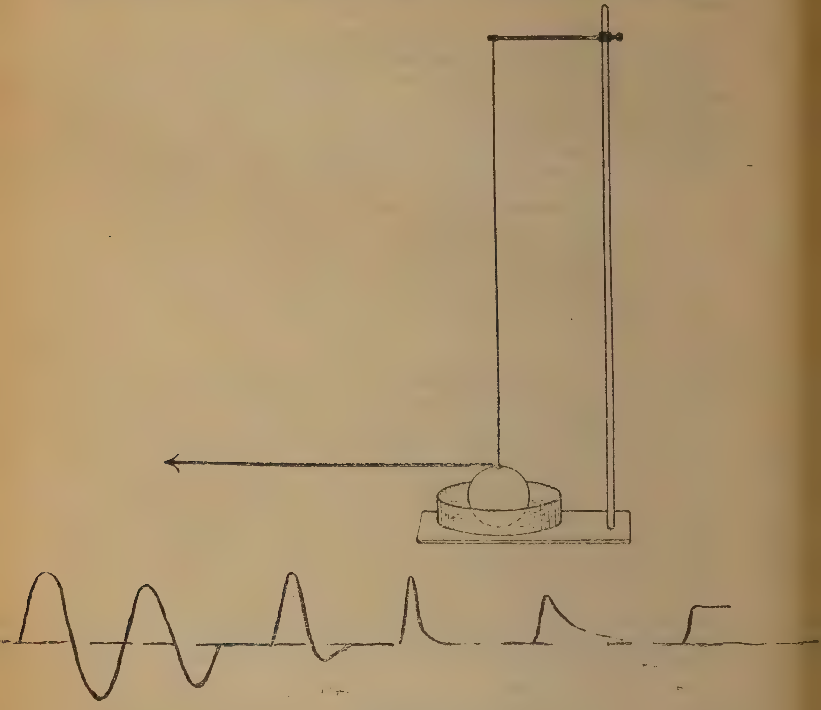


Fig. 2.—Model showing the effect of molecular friction in modifying the response curve: (*a*), (*b*), (*c*), (*d*), and (*e*) show the effects of gradually increased friction. (*a*) Persistent after-oscillation; (*b*) and (*c*) damped vibration; (*d*) recovery prolonged; (*e*) recovery arrested.

Model Exhibiting the Effect of Molecular Friction.

Torsional pendulum.—This torsional pendulum—a wire with a dependent sphere—will represent to us the molecule. By the stimulus of a blow, there is a torsional distortion produced. You see the response and recovery (Fig. 2). There is no friction, and there is a persistent after-oscillation. (*a*) I introduce friction by raising a vessel full of sand which touches the pendulum. You observe that there is now a damping of oscillation. (*b* and *c*) Under greater friction there is a response, but the recovery is gradual. (*d*) Increasing the friction still more, we have a response, but no recovery. (*e*) The pendulum is arrested in its strained position. When the friction is too great, there is no response.

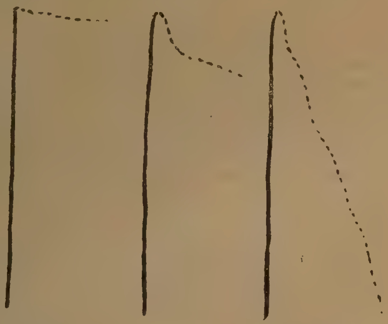


Fig. 3.—Different stages in the transformation of a coherer from a non-recovering to a self-recovering condition. (*a*) Response without recovery; (*b*) tendency towards self-recovery, owing to increased molecular mobility conferred by warming; (*c*) a more perfect stage of self-recovery.

If the conductivity variation produced by radiation is an expression of molecular distortion, we may expect all these phases repeated. First, in the case of non-recovering coherers the molecular friction is considerable. You observe a response without recovery. If we tap the pendulum arrested in its strained position, the friction is removed, and there is recovery. We do the same to the coherer—mechanical taps bring on immediate recovery. But we may get recovery without tapping. We must increase the molecular mobility. This may be done by warming. And you see how the receiver became self-recovering (Fig. 3). There are other substances in which the electric elasticity is very great and molecular friction small; in these cases we obtain an automatic and quick recovery (Fig. 4).

TRANSIENT AND PERMANENT AFTER-EFFECTS.

I find that all substances are sensitive to electric radiation. How is it, then, that we can obtain light images in only a few cases? Are all substances sensitive to light? Though almost all substances are molecularly affected by radiation, yet there is a great difference in the permanence of after-effect. The recovery is very quick in some cases, whereas in others it may be protracted. It is obvious that any method which attempts to develop the after-effect a long time after the exposure will not be successful in cases where there is a quick self-recovery. It will only be successful when the strain effect is more or less permanent. It is thus seen that it is quite possible for a substance to be sensitive to radiation and yet show no effect capable of photographic development, owing to self-recovery.

RELAPSE OF INVISIBLE IMAGE.

The above considerations offer a simple explanation of the obscure phenomenon of the relapse of invisible image. Recovery is only a question of time; with certain substances it is immediate, with others it takes a little longer time, as in daguerreotype, where the latent image disappears in the course of several hours. In the ordinary photographic plate the recovery may not take place for years. An instance has, however, been brought to my notice where the latent image on a film had disappeared after a year, the film afterwards becoming as good as if it had never been exposed.* We have seen how the strain effect of electric radiation was transient in some cases, whereas it was persistent in others. It is evident that in order to make the after-effect more or less permanent and thus render it developable, self-recovery should be retarded. There are two ways in which this may be done:—(1) Even a highly elastic substance may be rendered more or less permanently distorted by straining it beyond the limit of elastic recovery; (2) or the presence of an "arrestor" may prevent the self-recovery of the sensitive material by increasing the molecular viscosity; of this latter I shall speak presently.

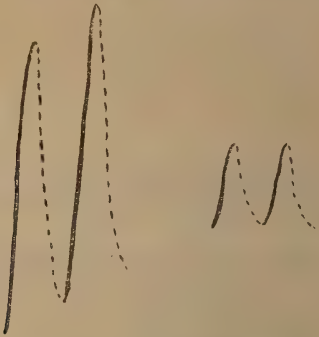


Fig. 4.—Responses of the artificial retina. (*a*) To flashes of electric radiation (*b*) to flashes of light. (Thick lines represent the effect of radiation; dotted lines, the recovery.)

Permanence of the after-effect by overstrain.—In many cases where images cannot be obtained with ordinary exposure, they can be obtained with excessive strain caused by prolonged exposure. Thus Moser and Waterhouse obtained invisible images on plates of silver or gold. These images could be developed not only by mercury or water vapour, but also by ferrous sulphate or pyrogallic developers. All these results derive an additional interest from the fact that most of the phenomena that occur by exposure of ordinary photographic plates containing haloid compounds of silver can also be observed upon a silver plate exposed to light.

PHENOMENA OF REVERSAL.

Reversed effect due to sub-normal intensity of stimulus.—A very curious effect I have often noticed is the following. If the effect of normal intensity of electric radiation is to produce a diminution of resistance, or say positive effect, a feeble intensity of radiation gives rise to negative effect. It thus happens that when a receiver is subjected to continued radiation, the first moiety absorbed falls below the critical intensity; there is thus a preliminary negative twitch followed by the normal positive response.

Reversal due to continued radiation.—If the receiver is subjected to the long continued action of radiation there is produced a reversal. In some cases I have even noticed recurrent reversals.

ARTIFICIAL RETINA.

The receiver hitherto described responds to invisible electric radiation. But I have been able to construct others which respond to all lights—visible and invisible. Last year I exhibited at the Royal Institution an artificial eye, which in many respects was an improvement on the human organ. It also exhibited an automatic recovery just like our own eye. This artificial retina has, with regard to spectral vision, an enormous range extending far beyond the visual limits. It perceives light waves several miles in length; it can also see waves less than one-fifty thousandth part of an inch. But we can reduce its power to a merely human level by substituting a water lens instead of the glass substitute for the crystalline lens, when the invisible radiations are absorbed by water and prevented from reaching the sensitive layer.

The following records, Fig. 4, show how the receiver exhibits responses when alternately acted on by light and electric radiation, and how similar in every respect are the two sets of responses.

The responses obtained with this retina are in every way correspondent to the visual responses.

ELECTRIC THEORY OF VISION.

According to this theory, the visual impulse is an electric impulse (an electric impulse in the optic nerve is known to produce visual sensation). The nerve is a conductor of electric current, and the brain an extremely delicate detector of current. The most difficult part of the subject is to explain the production and regulation of visual current in response to the fluctuating stimuli of the incident light on the sensitive substance in the retina.

RETINAL CURRENT.

If there are electro-motive elements in the retina, then the visual current may be supposed to be regulated by the conductivity change of the sensitive layer under the action of radiation. But it is not even necessary to postulate the existence of any electro-motive element. I will show that the stimulus of light itself will give rise to an electro-motive variation. Let us first take a frog's retina, and see what takes place under the action of light. We shall find out whether exactly similar phenomena is not repeated in an artificial substitute. We take first the frog's retina, and see what takes place under the means of non-polarising electrodes, one with the cornea and the other with the optic nerve (the slight existing current may be balanced by a potentiometer). On now exposing the retina to light, a responsive galvanometer twitch will be produced. On stopping the light, the galvanometer deflection will show recovery. We next take a rod of silver and beat out one end in the form of a hollow cup, sensitising the inside by exposing it for a short time to the vapour of bromine. The cup is filled with water. We have thus an arrangement somewhat resembling the eye, the sensitive layer corresponding to the retina, and the less sensitive rod corresponding to the nerve-stump. Connections are made with the galvanometer by means of non-polarisable electrodes, one contact being made with the sensitive layer inside the cup, and the other with the rod.

Retinal current in response to light has been observed by Holmgren, Dewar, McKendrick, and others. I have also obtained similar responsive currents with the inorganic substitute for the retina. The response curves of the real and artificial retinæ are under all possible variations absolutely alike. I will now try to interpret the meaning of a few curves obtained with the artificial retina, and tell you how by their means I was able to discover some unexpected peculiarities of our own vision.

Effect of Light of Short Duration.

If we subject the senstive cell to a flash of light, the effect is not instantaneous, but grows with time. It attains a maximum some little time after the incidence of light, and the effect then gradually passes away. If now a flash of light of stronger intensity falls on the cell, it will be found that the after-effect persists for a longer time (Fig. 5). The following visual analogue is interesting. If a bold design be traced with magnesium powder on a blackened board, and placed in a dark room, the observer not being acquainted with the design, and the powder is fired, the instantaneous flash of light, besides being too quick for detailed observation, is obscured by the accompanying smoke. But if the eyes be closed immediately after the flash, the feebler obscuring sensation of smoke will first disappear and leave clear the more persistent after-sensation of the design, which can now be read distinctly. In this manner I have often been able to see distinctly, on closing the eyes, extremely brief phenomena of light which could not otherwise have been observed.

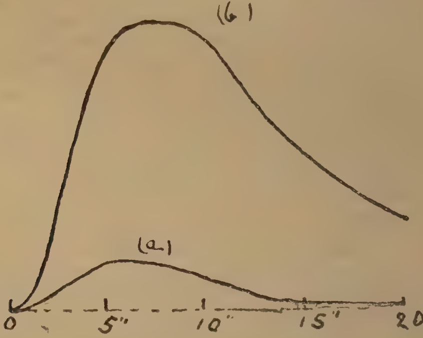


Fig. 5.—Response curves for flashes of (*a*) feeble and (*b*) strong lights.

After short exposure the after-effect is positive, there being no reversal or interval of darkness between the direct image and the after-image, one being merely the continuation of the other. In the next type, to be presently described, there is an intermediate reversal.

After-oscillation.

When the silver cell has been subjected to strong light, the current of response attains a maximum; on the stoppage of light there is an immediate rebound towards recovery. In this rebound there may be overshooting of the equilibrium position, and an after-oscillation is thus produced (Fig. 6). Translated into the visual circuit, this would mean an alternating series of after-images. On the cessation of light of strong intensity and long duration, the immediate effect would be a negative rebound; the next rebound is positive, giving rise to a sensaton of light. This will go on in a recurring series. If after staring at a bright object, preferably with one eye, one looks on a dimly-lighted wall, both the dark and the bright phases will be noticed alternately. The negative effect is usually explained as due to fatigue. That portion of the retina affected by light is supposed to be "tired," the negative image being due to fatigue or exhaustion. If this were the case, we should expect that this fatigue, with its consequent negative image, would gradually and finally disappear on the restoration of the retina to its normal condition. We find, however, that this is not the case, for the negative image recurs with alternative positive image. The accepted theory of fatigue is incapable of explaining the phenomenon. The observed effects point to a process of after-oscillation, exactly similar to that found in the sensitive cell.

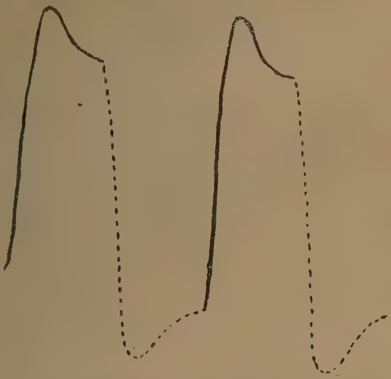


Fig. 6.—After-oscillation on the cessation of light. Thick lines represent the action of light, dotted lines the recovery and after-oscillation.

BINOCULAR ALTERATION OF VISION.

It was while experimenting on the phenomenon of recurrent vision that I discovered the curious fact that, in normal eyes, the two do not see equally well at a given instant, but that the visual effect in each eye undergoes fluctuation from moment to moment in such a way that the sensation in one eye is complementary to that in the other, the sum of the two sensations remaining approximately constant. Thus they take up the work of seeing and then relatively resting, alternately. This division of labour, in binocular vision, is of obvious advantage. As regards maximum sensation in the two retinæ, there is then a relative retardation of half a period. This effect can be exhibited by means of a stereoscope carrying incised plates through which we look at light. The design consists of two slanting cuts; one cut slants to the right, and the other to the left. The right eye sees the one, and the left the other. On looking through the stereoscope, the two images will be superposed, and we see an inclined cross. After staring at the design for some time, if the eyes be closed, the after-effects will be perceived. Owing to the retardation of half a period, it will be found that the after-image is not a complete cross. Only one luminous arm of the cross shoots aslant the dark field and then slowly disappears; after this the second arm (perceived by the other eye) shoots out suddenly in a direction athwart the first. This alteration proceeds for a long time. That this is due to physical causes is seen from the fact that early in the morning, after long rest, the period is shortest; later in the evening, the period is lengthened (from about four to seven seconds). Again, if one eye be cooled and the other warmed, the oscillation in one eye is quicker than in the other; we thus obtain visual beats.

These after-effects sometimes persist for a very long time. It sometimes happens that owing to weariness the recurrent images disappear, but afterwards at most unexpected moments they will spontaneously reappear. In connection with this, the revival of images (on closing the eyes at night) that have been seen during the day is extremely interesting.

Another striking way of exhibiting the alternation is to look at two different sets of writings with the two eyes. The resultant effect is a blurr, due to superposition, and the inscription cannot be read with the eyes open. But on closing them the composite image is analysed into its component parts. We are thus enabled to read better with eyes shut than open!

VISUAL IMPRESSION OF LIGHTNING.

In photographs of lightning it is sometimes found that the image comes out (1) as bright core with dark border, and (2) with dark core and bright edges. If we look at a single discharge from an electric machine and immediately close the eye, we shall find exactly the same phenomenon reproduced. That is to say, we see a bright line of discharge bordered by intense dark edges—the edges being much darker than the rest of the dark field. After a while, owing to reversal, we find the inner core becoming dark and the edges becoming bright. One explanation of this curious phenomenon is the following:—We have seen that the molecular effect of electric radiation below a certain critical intensity is opposite to the normal effect. Now the image cast on the retina is sharp in the centre, gradually vanishing at the edges. It may thus be that at a certain limit the radiation intensity is below the critical value, hence the opposite effects at the centre and the edges.

The same cause—molecular strain—which gives rise to the photographic image also produces the visual impression. The difference lies in this. The retinal images are transitory; there may be sight echoes which grow fainter and fainter, at last merging into memory. In the photographic plate something is wanted which will arrest the fleeting image. We shall presently see how this may be accomplished.

The responses in the artificial retina, normal or abnormal, are exactly the same as that obtained with the real retina. The observed visual phenomena follow as a matter of course from the correct interpretation of the response curves. From observing the peculiarities of an artificial organ we are even able to discover unsuspected peculiarities in our own.

VITAL RESPONSE.

But the vitalists may object and say that vision is a phenomenon peculiar to the living. The visual responses are regulated by "vital force," which is much more subtle than mere physico-chemical forces which govern the world of brute matter. Let us now examine what is meant by this vital response, and what are its characteristics.

The effect of stimulus on living substances is usually detected by two different methods. Mechanical response is obtained in the case of contractile tissues such as muscles. But in others—nerve for example—stimulus causes no visible change; the excitation of tissue may, however, be detected by the electro-motive changes caused by the stimulus. The advantage of the electric mode of detecting response is its universal applicability. In cases where mechanical response is available, as in muscle, it is found that simultaneous mechanical and electrical records are practically identical. The intensity of electrical response is found to depend on the "livingness" of the tissue. When this activity is diminished by anæsthetics the intensity of electric response is also correspondingly diminished. When the tissue is killed, the response disappears altogether. Hence physiologists declare that "the most general and most delicate sign of life is the electrical response."

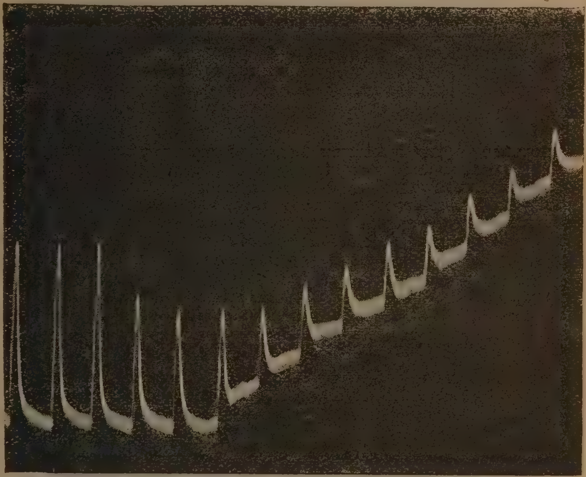


Fig. 7.—Anæsthetic effect of chloroform on the response of plant. Uniform stimuli were applied at intervals of one minute. The rising part of each portion shows the effect of stimulus, and the falling part shows recovery. The first three are the normal responses, after which, on the application of chloroform, the "electric pulse" underwent a rapid decline.

A living tissue is irritable, that is to say, stimulus evokes a molecular disturbance, with its concomitant electric disturbance. On the cessation of stimulus the electric disturbance gradually disappears; a living tissue is, however, ever responsive; it responds to a second stimulus, and exhibits subsequent recovery. A living thing is capable of dying; we may hasten death by the action of poison, and at the approach of death the electric response disappears. The effect of poison in abolishing response is thus regarded as the physiological test of a vital phenomenon.

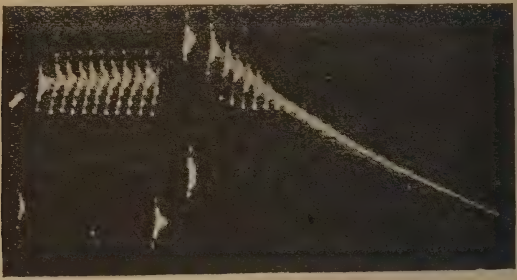
RESPONSE IN ORDINARY PLANTS.

The gap between animal and metal is very great. I therefore undertook an investigation on the responses in the transitional world of plants, to find out whether they resembled the animal responses. Some sensitive plants are known to exhibit response, but it was thought that it ended there, that ordinary plants exhibited none.

Here is a leaf stalk of cabbage. I stimulate it by pinching, and you observe the immediate electric response; you see that the stimulus of a pinch or vibration evokes an electric twitch, followed by recovery. To show that the response is physiological, I poison the plant or kill it by hot water; the response, you see, has now disappeared. I chloroformed a plant, and you see in the record the gradual abolition of the electric "pulse" under the anæsthetic action (Fig. 7).

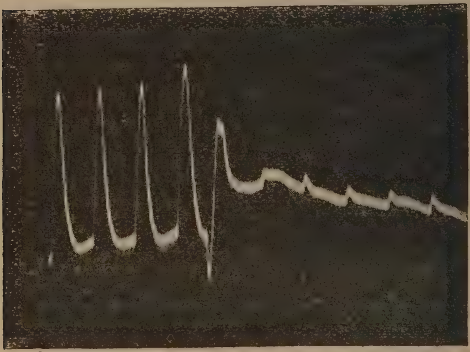
VITALISM.

From the observed fact—that a tissue when killed passes out of the



(*a*)

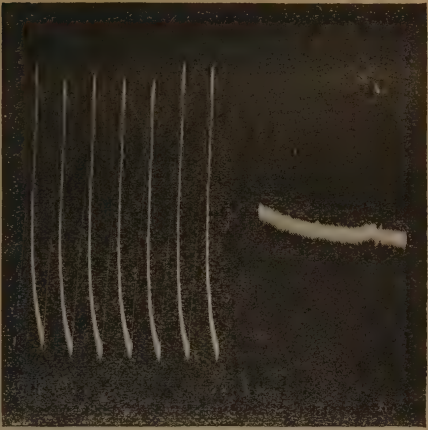
Before. After.



(*b*)

Before. After.

Fig. 8.—Effect of the same poison in abolishing the response in (*a*) nerve (Waller), (*b*) plant, and (*c*) metal.



(c)

Before. After.

state of responsiveness into that of irresponsiveness—and from the confusion of "dead" things with inanimate matter, it has been tacitly assumed that inorganic substances must necessarily be irresponsive. From this false assumption, that the inorganic is irresponsive, it was argued that the responsive phenomenon must be quite distinct from the physico-chemical phenomenon, and must be due to a mysterious "vital force."

This unexplained phenomena of response "became the starting point," to quote Verworn, "of vitalism, which in its complete form asserted a dualism of living and lifeless nature. The vitalists soon laid aside, more or less completely, mechanical and chemical explanations of vital phenomena, and introduced as an explanatory principle an all-controlling, unknown, and inscrutable 'force hyper-mechanique.' While chemical and physical forces are responsible for all phenomena in lifeless bodies, in living organisms this special force induces and rules all vital actions. In place of a real explanation, a simple phrase such as 'vital force' was satisfactory. Thus it was easy to 'explain' the most complex vital phenomena."

From this position, with its assumption of the super-physical character of response, it is clear that on the discovery of similar effects amongst inorganic substances, the necessity of theoretically maintaining such dualism in Nature must immediately fall to the ground.

INORGANIC RESPONSE.

Taking a piece of metallic wire, I substitute it for the plant, all the rest of the apparatus and connections being precisely the same as before.*

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* For detailed description of experimental arrangements, see "Response in the Living and Non-Living." (Messrs. Longmans.)

I now stimulate the metal by mechanical stimulus—a tap or vibration—and you observe that the galvanometer spot on the scale, hitherto quiescent, moves, thus exhibiting the current of response. I stop the disturbance, and you see the spot creeping back to its original position, exhibiting a complete recovery. A difference of electric potential, sometimes very considerable (4 volt) is thus produced between the excited and less excited parts of the same wire which was originally iso-electric. The more excited portion of the wire becomes, generally speaking, zinc-like, and the less excited copper-like. We may express the same fact by stating that the chemical activity of the stimulated portion of the wire has become relatively greater than the unstimulated portion.

As long as the wire is excited, so long will the electric response persist. Greater intensity of stimulus will produce stronger response. Finally, just as the response of animal tissue undergoes modification by various chemical re-agents, being excited by stimulants, lowered by depressors, and abolished by poisons, so also we find the response of metals undoing similar exaltation, depression, or abolition by the action of various chemical re-agents. These three records show how the same poison kills the response in nerve, plant, and metal (Fig. 8). Still more curious is the phenomenon, known not only to students of physiological response, but also in medical practice, that of the opposite effects produced by the same drug when given in large or in small doses. We find the same phenomenon reproduced in an extraordinary manner in inorganic response—the same re-agent which is a poison in large quantities acting as a stimulant when applied in small doses. We see that the "vital" response so called is in reality a physico-chemical phenomenon. We have thus in the artificial retina a mechanism whose action explains that of the real retina.

I have shown how all matter—living and non-living—is responsible to all kinds of stimulus; how the molecular disturbance thereby caused expresses itself in various ways; how the question of molecular friction determines whether the after-effect should be transitory or permanent. We have seen how the curves of response obtained by such widely different methods as those of conductivity or electro-motive variation are yet exactly similar.

Instead of applying mechanical stimulus we might apply the stimulus of light, and we would get exactly similar results. The study of the response curves given by a wire under mechanical stimulus will give us a general insight into the molecular effects produced by various stimuli under diverse conditions.

III.

Effect of Annealing.

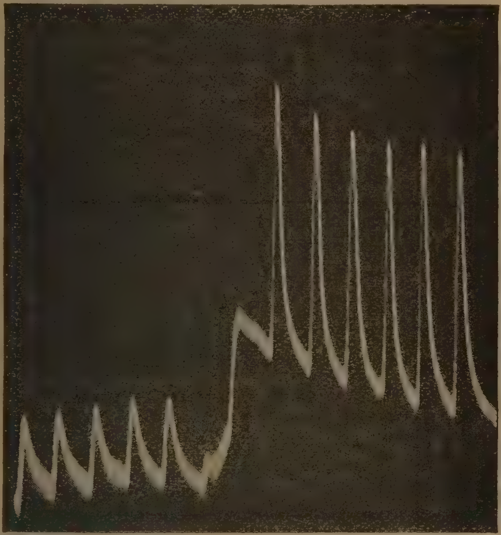
It is obvious to you that if we remove in any way the molecular friction, the response will be enhanced; in other words, the wire will be more sensitive to the same stimulus. Here you see the response of the same wire before and after annealing. In the latter case the response is nearly three times as strong. Sometimes the wire falls into a sluggish condition, and there is no response. But annealing makes the wire sensitive. You will at once notice the meaning of annealing in enhancing the sensitiveness of the photographic plate.

Effect of Stimulants and Depressors..

The action of Na_2CO_3 as accelerator and of KBr as retarder is known to you. Curiously enough, the former agent is found to act as a great stimulant (enhancing the response) (Fig. 9), and the latter as a depressor of response (Fig. 10).

RELATION BETWEEN STIMULUS AND MOLECULAR EFFECT.

If the intensity of stimulus is increased, the molecular effect as exhibited by response is also found to increase. But the curve showing the relation between stimulus and response is not a straight line. In the first part it is slightly concave to the abscissa (representing the molecular effect); it is then straight, and in the last part concave. A limit is approached as the intensity of stimulus reaches a high value. You will notice an exact parallel in photographic action.



Before. After.

Fig. 9.—Stimulating action of Na_2CO_3.

EFFECT OF SUPERPOSITION.

If the stimulus is very feeble it hardly produces any effect, but single ineffective stimulus becomes effective by superposition. I give a typical curve which shows the effect of continued stimulation; it shows several distinct stages (Fig. 11).

(1) A short latent period, when there is apparently little or no action, or even a transitory negative action.

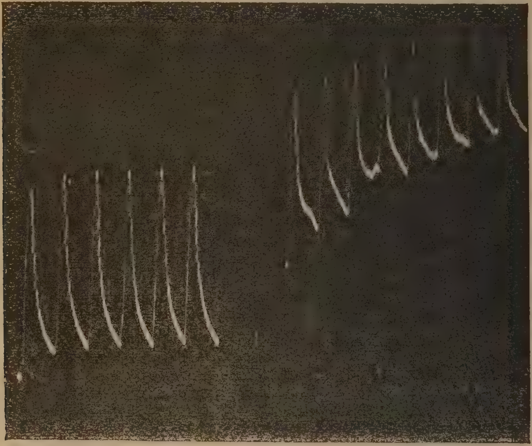
(2) After this stage the curve rises almost in a straight line. This is the stage of increasing action.

(3) The curve then reaches a maximum and becomes horizontal, after which it begins to fall, and may reach the original neutral line.

(4) After very prolonged stimulation, I have sometimes found the curve proceeding in the negative direction, thus exhibiting molecular reversal.

All these peculiarities I find not only under the continued stimulus of mechanical vibration (electro-motive variation method), but also under light (electro-motive variation), and also under electric radiation (conductivity variation method).

The first part of the curve, or the latent period, is very suggestive as regards the obscure phenomenon of photographic induction. "When a mixture of chlorine and hydrogen which have been kept in the dark is exposed to the light, there is either no hydrochloric acid or only a very small quantity formed in the first moment, but the rate of formation increases so that the quantity formed in a given time, *e.g.*, one minute, continues to increase until it attains a maximum. Bunsen terms the gradual increase in the action induction. If the gaseous mixture has been once exposed to the light, it will retain in the dark for about half-an-hour its capacity of forming HCl in the light. If the gas has remained in the dark for a short period, and is again brought into the light, it requires a very short period of induction, but the period of induction will be lengthened by keeping the mixture in the dark for a long time."*



Before. After.

Fig. 10.—Depressing action of KBr.

The latent period of the curve, due to molecular inertia, would thus appear to offer an explanation of induction. In connection with this it is interesting to note the well-known fact that a very slight preliminary exposure of the photographic plate enhances the general sensitiveness. This is no doubt due to the fact that the preliminary exposure had merely overcome the molecular inertia.

It would appear from the inspection of the curve that the general law of photo-chemical action, which regards the total photographic action as proportional to the product of the light intensity multiplied by the time of exposure, is subject to several modifying conditions. During the latent period this cannot hold good in the first part, nor can it be true after the maximum is reached. It can only hold good in the second stage, where the action proceeds uniformly.

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* This is evidently due to self-recovery.—J. C. B.

EFFECT OF INTERMITTENCE IN MODIFYING THE LAW OF PHOTO-CHEMICAL ACTION.

But even at the second stage of uniform action there may still be deviation from the above law. If in one case the light be intermittent and in the other continuous, the effects may be quite different, though the total duration be equal. For in the former case, during the continuation of light, we may have the distortion or molecular swing proceeding in one direction, but on the stoppage of light, the swing stops too, and owing to self-recovery may even become reversed. After an interval, when the light is again allowed to act, it has not only to overcome the molecular inertia, but may have to reverse the negative swing. In the case of continuous illumination the molecular action proceeds without interruption. This is well seen in two curves I obtained, which show the difference in the extent of molecular effects produced in an AgBr cell by interrupted and continuous illuminations of the same total duration. In the case of interrupted illumination the molecular effect as measured by the galvanometer deflection was 7 divisions; with continuous illumination it was 11·5 divisions, or one and a-half times as great. It is thus seen that owing to self-recovery the effect of light with interrupted illuminations is less. It is also evident that the greater the period allowed for self-recovery (during the interval of darkness) the less will be the resultant effect. In connection with this, Abney's experiments are interesting. In comparing the relative effects of continuous and interrupted illuminations, he finds that in the latter case the effect

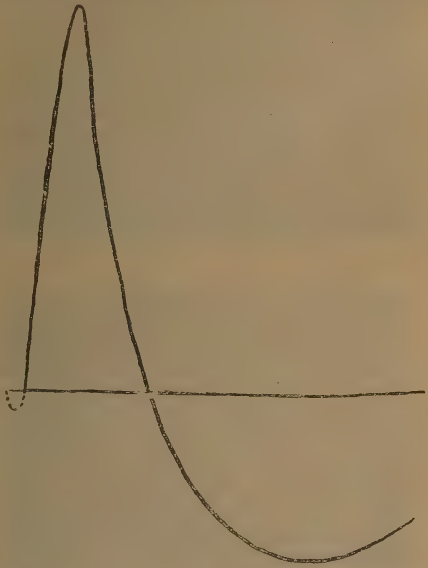


Fig. 11.—Curve exhibiting the molecular effects under continuous stimulation.

produced was always less, and that the longer the interval between the successive exposures, the smaller was the effect.

Photographic Effect Modified by the Time Rate.

It will thus be seen that the photographic effect is not solely governed by the total amount of radiation, but by the time rate also. This gives a simple explanation of the apparently anomalous result obtained by Mr. Wood ("Nature," November 30th, 1899). The photographic image of a single electric spark came out as a reversed positive, when the lens was wide open; but there was no reversal with four successive sparks with the lens aperture reduced to one-fourth. The quantity of light was the same in the two cases, but the time rate of illumination was different. In the first case the rate was quicker, and gave rise to a molecular reversal (see below).

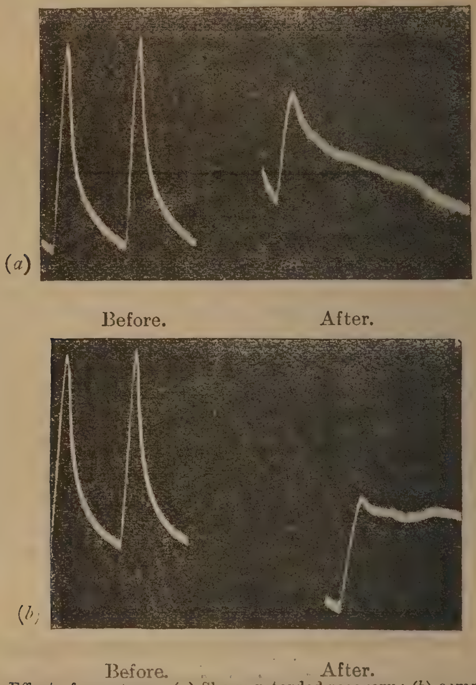


Fig. 12.—Effect of arrestors. (*a*) Shows retarded recovery; (*b*) complete arrest.

Phenomenon of Reversal.

After continuous stimulation—either mechanical or luminous—the curve of response is found to undergo reversal. Similar molecular reversal is found also under the action of continued electric radiation. The relation of this to photographic reversal is obvious.

ARRESTORS.

We have seen that the difference between the retinal image and the photographic image is that in the former it is fugitive and in the latter persistent. We have also seen that there are theoretically two ways of making the image permanent—(1) by overstrain; (2) by the influence of certain agents which would arrest the self-recovery, the molecular strain thus becoming more or less permanent. This photographic permanence of after-effect is merely a question of degree—from numerous evanescent effects which cannot be photographically detected to a little more permanent effect in daguerreotype, and still greater permanence in photographic plates. One of the chief functions of the so-called sensitisers appears to be, not so much to impart sensitiveness—for everything is more or less sensitive—but to make the light effect developable by arresting the self-recovery.

I have been recently carrying out a series of experiments to verify the supposition that with the help of the "arrestors" it is possible to render the strain effect permanent. The following records will speak more eloquently than I can about the manner in which the molecular arrest is brought about. First you see the normal response to stimulation and the immediate recovery. I add a small quantity of the arresting re-agent. There is the response, but the recovery is very much prolonged—from the normal one minute to five minutes. You have now a case comparable to the daguerreotype image. I add a little more of the arrestor. Here is the response, but the recovery is completely arrested. The impress of the stimulus has now become fixed. (Fig. 12. Compare also in the Fig. 2 *d e*.)

CONCLUSION.

It is thus seen:—

(1) That molecular strain is produced by the action of light.

(2) That both in the artificial and real retinæ the molecular strain produced by light gives rise to similar electric impulses.

(3) That as the physico-chemical properties of a substance are changed by strain, it is possible to develop the latent image through the difference in the following properties between the exposed and unexposed portions, produced by light: (*a*) Difference in adhesive power, *e.g.*, development of daguerreotype by mercury vapour; development by water vapour; (*b*) Difference in chemical stability, *e.g.*, development by reducing agents.

(4) That molecular strain may not only be produced by visible or invisible radiation, but also by (*a*) electric and (*b*) mechanical stress. Latent images produced by such means may be developed, *e.g.*, inductoscripts, development of pressure marks.

(5) That nearly all substances are sensitive to radiation, but the effect cannot in all cases be rendered visible, (*a*) owing to the want of suitable chemical developers; (*b*) owing to quick self-recovery. The effect may be rendered more or less permanent by overstrain or by "arrestors."

(6) That the molecular effect due to radiation can be demonstrated by the conductivity or E.M. variation methods.

(7) That the latent period of overcoming inertia corresponds to the photographic induction period.

(8) That the relapse of image is due to self-recovery.

NOTES ON DEVELOPMENT.

Testing Developers.

In 1886-87, having been engaged for some time in photographing spectra and using pyrogallol as a developer, I determined to abandon its use on account of stains that appeared on the plates, sometimes immediately, but occasionally after preservation for long periods.

To find some substitute, a number of developers new at that time were tried. The following is a list: Ferrous oxalate, quinol, resorcinol, pyrocatechol, hydroxylamine hydrochloride, with caustic soda.

Again in 1892 to this list was added: Eikonogen, amidol, rodinal, pyrogallol, a modified developer.

Of these quinol was chosen, and has been in use ever since 1887. The object in view being a true representation of spectra, ferrous oxalate was first put aside, because it was found not to give equal values to all rays throughout the whole range of the spectrum, from the yellow or green to the extreme ultra-violet. It was true that strong lines were developed, but the faint rays and the background of continuous rays important for the work in progress were not represented in their proper values. It was also proved that a comparatively long exposure was required to give an effect equal to that obtained with pyrogallol.

Resorcinol and pyrocatechol were put aside partly on the ground of expense, but also because of the long time required to develop with them. A preference was given to hydroxylamine for its cleanliness and efficiency, but here again there was a defect noticed in its use. On comparing the time required for a proper development with this reducing agent, it was found to be from six to seven minutes, while with quinol the same result could be obtained in from two to three minutes. In every case a constant source of radiant energy was employed, being the condensed electric spark from alloys of cadmium-tin and cadmium-lead used as electrodes.

The exposures in each case were the same, namely, either five seconds or two minutes, according to the width of the slit of the spectrograph, which varied from 1-50th to 1-2000th of an inch. In photographing some hundreds of spectra this difference in time became of importance, particularly when it is borne in mind that development took place in a covered dish and always for the same period, timed by a watch or sand-glass.

Out of doors, when photographing the flames from the Bessemer "blow" or the spectra produced by them at different periods in the progress of the operation, it was essential that the development should require as little time as possible since the plates were developed in a light-tight box, actually the packing case of the instrument, within which, by means of sleeves of rubber cloth, the hands were placed, in order to carry on the necessary manipulations of pouring the developer on and off, washing, and fixing the photograph.

The exposure was known to be correct in every case, but it varied from half a minute to 15 minutes, hence with a constant developer the time necessary for development was also known.

At various periods, when other reducing agents were obtainable, such as eikonogen and rodinal, experimental trials were made, but without finding that they were specially advantageous for this kind of work.

For landscapes, however, and for photographing operations in metallurgical or chemical processes, eikonogen mixed with quinol was successfully and advantageously employed, as, for instance, with a Goerz lens (Anastigmat Sec. III.) or Lynkeiskop lens and Anschütz-Camera, with exposures varying from 1-25th to 1-100th of a second. The quinol developer was used to intensify the negative after the eikonogen had secured all detail in the shadows.

It having recently become desirable to ascertain the properties of a number of the new developers now purchasable, the following have been compared with quinol:—Metol, ortol, eikonogen, paramidophenol, diogen, glycin, imogen sulphite, and adurol.

Certain conditions were looked upon as desirable: (1) the developer should be easy to make, (2) it should, if possible, be used without bromide, (3) it ought not to contain caustic potash or soda, (4) it should develop well when at a temperature as low as (10 deg. C.) 50 deg. F., or as high as (20 deg. C.) 68deg. F., and without much difference between the effect at either temperature, (5) it should develop rapidly, and not require any modification in its composition, either by strengthening or diluting, (6) it should be available for developing either plates, celluloid films, or bromide papers, that is to say, useful for either negatives or positives, and as a matter of course it should be useful with isochromatic plates. The Watkins system of timing development was adopted, and as far as possible a factor of 6 was adhered to as being found most convenient. At the outset, for what may be termed the preliminary experiments, a suggestion made by Mr. Watkins in his "Manual" was adopted by taking three parts of quinol with a factor of 4½ and mixing these with one part of ortol with a factor of 10, dividing by 4, we get very near to 6, in fact 5.87. In practice it was always reckoned as 6. In timing the development, the high lights began to appear in 20 seconds, and by dividing this by 10, and calling it minutes, all further calculation is obviated. This has been found to work very satisfactorily in the development of spools of films with as many as twelve exposures varying from 1-5th to 1-75th of a second. When the exposure was timed with the standard meter, there was no difficulty in getting twelve pictures from one length of film, each of which was correctly exposed and development at one operation. In no case out of 100 trials has under or over exposure resulted.

The lens used was a Goerz Anastigmat, Series III., No. 0, full aperture *f*6.8. Latterly an Aldis lens, No. 2, the full aperture of which is *f*6, has been employed.

ON THE EXHAUSTION OF A DEVELOPER.

The quinol-ortol developer has proved to be capable of giving just the effect seen in a landscape under different atmospheric conditions, such as bright sunshine, rain, or mist. It correctly represents figures in white costumes out of doors, both at short distances and at 100 to 200 yards. Blue sky and clouds are very well represented on films and plates even without the use of a colour screen. The delicate colours seen on the surface of falling water are also properly rendered, and, therefore, the quinol-ortol developer may be considered as very satisfactory for negative work.

As the developer does not stain and does not become brown, but only yellow by use, it may be employed again and again until exhausted. The following experiments were made to ascertain the extent of film which could be developed with a given volume of solution of known strength.

The developer was made from compressed tabloids as follows:—

Quinol, 6 tabloids,
Accelerator for quinol, 6 tabloids,
Water, 6oz.

Ortol, 2 tabloids,
Ortol accelerator, 2 tabloids,
Water, 2oz.

These were generally mixed together after undergoing solution, but in the instance from which the following notes were written, the tabloids were dissolved at once in 8oz. of water, contained in a 10oz. bottle. The space of 2oz. was available for hastening solution by shaking vigorously. Twenty-four pictures taken on four quarter-plate spools of six exposures each, were successfully developed, washed, and fixed, without cutting separate pictures off the lengths of film. Exposures varied in duration from ½ to 1-20th of a second. The first spool of six pictures required 45 seconds for the high lights to become visible and development was completed in 4½ minutes afterwards. The second required one minute for the pictures to appear, and they were completed in 6 minutes afterwards. The third, 1½ minutes, were completed in 10½ minutes afterwards. The fourth, in 2½ minutes, were completed in 12½ minutes additional, or from first to last in close upon 15 minutes. It will be observed that the factor of 6 was maintained throughout.

The developer at the close of all the operations was of a leathery brown colour and turpid. It had a strongly blue fluorescence, caused apparently by something dissolved out of the film. The same colour was noticed in the washing water through which the films were first passed. The "hypo" solution also had the same fluorescent appearance and a brown colour. Hence it is not advisable with 8oz. of solution to try and develop more than twenty-four 4¼ x 3¼ pictures, or to fix more than this number with the same "hypo" solution.

It may be added, however, that as many as two spools of twelve exposures each and one of six have been developed in this way, making in all thirty pictures. The time occupied in each case was much the same as that given in detail above, and need not be repeated.

Objection to Some of the Modern Developers.

In the use of large quantities of sodium sulphite in conjunction with alkaline carbonates a somewhat concentrated solution is obtained which does not readily penetrate by diffusion into the inner parts of the film, or, to put it in another way, the surface layers of silver bromide are more readily reduced than those which lie below. This may be considered to be the cause of a sort of flatness or excessive softness in the picture. Another objection is the necessity for using an acid bath to avoid either blistering or stains in the film. There is a great difference recognisable in different developers as regards the manner in which the picture appears. Thus in some the high lights develop much sooner and more easily than the detail in the shadows; it is, therefore an advantage to be able to use some agent which enables both to grow in strength together. In this manner both high lights and shadows have their proper values. The instruction "to develop for the shadows and let the high lights take care of themselves" is bad in principle, because, though it imparts a rough and ready method which is to a certain extent successful when working with imperfect developers, it becomes impossible when plates or films are not all the time under observation. When implicitly obeyed, it frequently leads to a loss of cloud form, and a faulty interpretation or rendering of atmosphere. In a landscape the clouds and the aerial perspective may often be the only features which constitute the picture. Metol and adurol are good in this respect, that the shadows follow very closely upon the high lights, but the best are glycerine and imogen sulphite. This last has a trace of some pink dye added to it which imparts a slightly warm tint to the paper, and doubtless also to the black and intermediate shades on paper prints; the reducing substance itself, which may be re-crystallised from a solution, is quite colourless. It forms crystals perfect in form, of large size and high refractive power.

A developer which renders detail before the high lights are well developed is apt to cause a flatness and want of contrast which is unnatural, and has a depressing appearance, without that richness representative of colouring which is desirable.

EXPERIMENTAL DETAILS ON THE EFFICIENCY OF DEVELOPERS.

To test the value of developing agents it was found convenient to commence with bromide papers, working with one negative, the proper exposure for which was accurately determined beforehand. The same source of artificial light was always employed. The negative selected was one taken for the purpose of presenting softness in the shadows with atmosphere, and at one or two points in the picture a fair amount of contrast. A street scene on a wet day, where a gleam of sunshine was reflected from some windows and from the puddles in the roadway, was chosen. The reflections afforded high lights which contrasted well with one or two figures in black or dark costumes seen in the street. An interesting experience in development when taking this view may be related.

Four plates were rapidly exposed in succession for 1-10th of a second at 3 p.m. on November 25th, 1902; the aperture was *f*6 in one case and *f*11 in another. The plates had been stored in a room not colder than 60 deg. F., hence they had been kept in a properly sensitive condition.

The developer first tried was diogen made as follows, according to the printed directions sold with the substance:—Water, 9oz.; sodium sulphite crystals, 3½ oz.; diogen, 7drs.; potassium carbonate, 4½oz. For correctly exposed plates of a normal character, take of the concentrated solution of diogen as above, 4drs.; water, 2oz. 1dr.; and of a 10 per cent. potassium bromide solution 2 drops. If it be doubtful whether the exposure is correct, try first with a dilute developer made as follows:—Diogen solution, 85 minims; water, 3½ oz.; potassium bromide, 10 per cent. solution, 1 to 10 drops., Raise the temperature of the developer to 68deg. F., put the plate into it, rock the dish, and observe how long the high lights take to appear. If by the end of four minutes the picture is developed the exposure has been correct. If later, the plate is under-exposed; if sooner, over-exposed.

Fresh developer at the proper temperature was used for each plate; (a) *f*6, no image appeared after 8 minutes; (b) *f*11, no image appeared with the strong developer after 4 minutes; (a) and (b) were both washed with water, and Hauff's adurol normal developer was poured on to each plate; in each case the picture was developed well in about the usual time. Hence it appears that adurol is a much more efficient developer than diogen.

PARAMIDOPHENOL.

To test the value of this developer bromide paper was used. The best of the plates of the street scene, Stephen's Green, was exposed with a Bray burner at a distance of 18 inches, and an exposure of 4 seconds. The developer was made in two solutions as directed by the vendors :—

(No. 1). Paramidophenol, ¾oz.; sodium sulphite crystals, 4oz.; distilled water, 34oz.

(No. 2.) Potassium carbonate, 4oz.; sodium sulphite crystals, 4oz.; distilled water, 68oz. Mix for use 1oz. of (1) with 2oz. of (2).

It was found that the paramidophenol did not dissolve unless the liquid (No. 1) was heated to (83 deg. C.) 181 deg. F., and that as it deposited crystals on cooling, it became necessary to heat about 34oz. of water to 212deg. F., and make the solution up to 68oz. For use equal volumes of (1) and (2) were mixed. (The actual quantities used were the third parts of the above. Thus, ¼oz. paramidophenol, 1oz. sodium sulphite, and 11oz. distilled water; but instead of 11oz. there were taken 22oz., and equal volumes of (1) and (2) were mixed.)

The following is the result of the trial :—

A. Stephen's Green, bromide paper, paramidophenol normal developer as above. Temperature 68 deg. F.

B. The same developed with equal volumes of (1) and (2), where (1) had double the quantity of water.

In each case the pictures began to appear in 15 seconds, and were finished in 3½ minutes.

There was no difference apparent between them.

IMOGEN SULPHITE.

C. Stephen's Green as above developed with normal imogen sulphite solution at 68 deg. F. Two volumes of A. solution and one volume of B. as directed.

The picture appeared in 15 seconds, and was fully developed in three minutes. Result brilliant.

GLYCIN.

D. Stephen's Green, as before. Developed with normal glycin solution. Two volumes of A. and one volume of B. Result, a brilliant print. The first appearance was at 30 seconds and development was completed at three minutes.

Hence, it appears that if there is any difference between these reducing agents, when used for bromide prints, the advantage lies with imogen sulphite and with glycin. The imogen sulphite is very easy of preparation. It is simply dissolved in twelve times its weight of water, or, if the weight is taken in grammes, the volume of water is twelve times as many cubic centimetres as there are grammes weight.

In any case the temperature must not fall below (20 deg. C.) 68 deg. F., because at this temperature the solution is saturated, and cooling causes some of the imogen salt to separate; a notable proportion crystallises out at (10 deg. C.) 50 deg. F The solution B. or accelerator is sodium carbonate or washing-soda crystals (a saturated solution at 60 deg. F), and is, therefore, of the simplest possible composition.

METOL.

The same negative and paper were used with a normal exposure of four minutes. Four pictures were made, the developer being used under different conditions.

a. Strong solution, 1 to 3 at (11.5 deg. C.) 52.5 deg. F.
b. Dilute solution, 1 to 5 at (25 deg. C.) 68 deg. F.
c. Dilute solution, 1 to 8 at (11.5 deg. C.) 52.5 deg. F.
d. Dilute solution, 1 to 8 at (25 deg. C.) 68 deg. F.

There was a want of brightness in a. and b., through insufficient contrast, in one or two places; thus, the light reflected from windows and from water in the street was slightly veiled, not white. One or two dark figures were not so crisply rendered as the eye observed them; the photograph, therefore, lost its picturesque effect. With c. and d. these points were faithfully rendered, and so was the blue of the sky; moreover, there was very little or nothing to choose between them, though one was developed at a temperature of (11.5 deg. C.) 52.5 deg F., and the other at (25 deg. C.) 68 deg. F.

This was, therefore, satisfactory

ADUROL.

It may be mentioned here that this developer had been used and approved of before these systematic experiments were commenced, but it was considered desirable to institute a strict comparison. Adurol is monochlor-quinol, and, therefore, may be considered to be possessed of many of the good properties of quinol, while it is likely to be of greater stability. The solution was made in the following manner:—In 250 cc. of water are dissolved 150 grs. of potassium carbonate; when the salt was in solution 12.5 grs. of adurol were added. For studio work and for "snap-shots," take one volume of the solution and mix with three volumes of water, or, say, 10 cc. with 30 cc. For time exposures out of doors, one volume with five volumes of water. With plates inclined to fog, add 10 to 15 drops of a 10 per cent. solution of potassium bromide to each 4oz. or 112 cc. of developer. For bromide papers it was found that development was better when the solution was mixed with 10 volumes of water, especially when the pictures were of large size, as, for instance, 10 x 12 inches. The timing of development is not affected by such dilution.

The following tabular arrangement shows the efficiency of different developers when used with plates exposed for the same time and the same view, the camera being the same, the exposures being successive:—

	Picture began to appear.	Fully developed.	
1. Imogen sulphite	45 sec.	165 sec.	
2. Metol	15 sec.	180 sec.	
3. Paramidophenol	30 sec.	135 sec.	
4. Glycin	45 sec.	180 sec.	
5. Ortol .... At least	120 sec.	900 sec.	No picture
6. Quinol	15 sec.	90 sec.	
7. Quinol-ortol (3 to 1) Abt.	30 sec.	120 sec.	
8. Imogen sulphite 20 to	25 sec.	150 sec.	

Nos. 1 and 2 were quite satisfactory, 3 and 4 were not dense enough. No. 5 failed to develop a picture, 6 and 7 were rather deficient in density, but 8 was satisfactory. It will be noticed that this last plate was rather longer in the developer than the two immediately preceding. The timing of the No. 1 imogen sulphite developer was not quite exact at the commencement, and therefore another trial, No. 8, was made with a fresh quantity of the same solution.

The Kodak non-curling film, which is isochromatic, was exposed on May 1st and 2nd, for various periods, varying from 1-20 to ½ second. The six exposures were developed with the normal solution of pyrogallol prescribed, and, though all six exposures gave good negatives, they were stained a slight brownish tint. Staining is the sole objection to this developer, as mentioned before, and the addition of sodium sulphite is not an efficient remedy.

Professor W. N. Hartley, D.Sc., F.R.S.

Royal College of Science, Dublin.

A SWINGING STAGE FOR PHOTO-MICROGRAPHY.

Having to practise photo-micrography in close proximity to a railway line, with a heavy traffic, it occurred to the writer that a swinging stage for the camera and microscope would prevent the excessive vibration from affecting the sharpness of the photograph.

For photo-mechanical reproduction, the swinging support for camera and easel has entirely removed the difficulty that was at one time considered insurmountable, of obtaining sharp negatives when the studio was in a busy thoroughfare, or when machinery was working in the same building.

In process work the necessarily prolonged exposure (from ten minutes to half an hour) and the long extension of camera were the causes of the image becoming blurred through vibration caused by the street traffic or machinery. To overcome this nuisance most of the earlier photo-etching firms removed their studios into the country, till the method of preventing vibration by swinging the camera from the ceiling was introduced.

This method of preventing (or rather synchronising) vibration by suspending the apparatus might be followed with advantage by all photo-micrographers whose studios are situated in a busy street or in the vicinity of railways or machinery. In process work the camera is swung from the ceiling. This plan of course is out of the question for private studios, though it could be adopted for large laboratories. The following photograph shows the form of swinging apparatus devised by the writer for use in an ordinary study.

It will be noticed that the camera, microscope, and condensers are suspended on a stage from two iron struts or arches. This form of suspension takes up very little space, and the appartus is comparatively light and portable. This swinging stage can be easily constructed, and costs little for material. The staging and base-board were made of American whitewood. This was selected on account of its lightness and

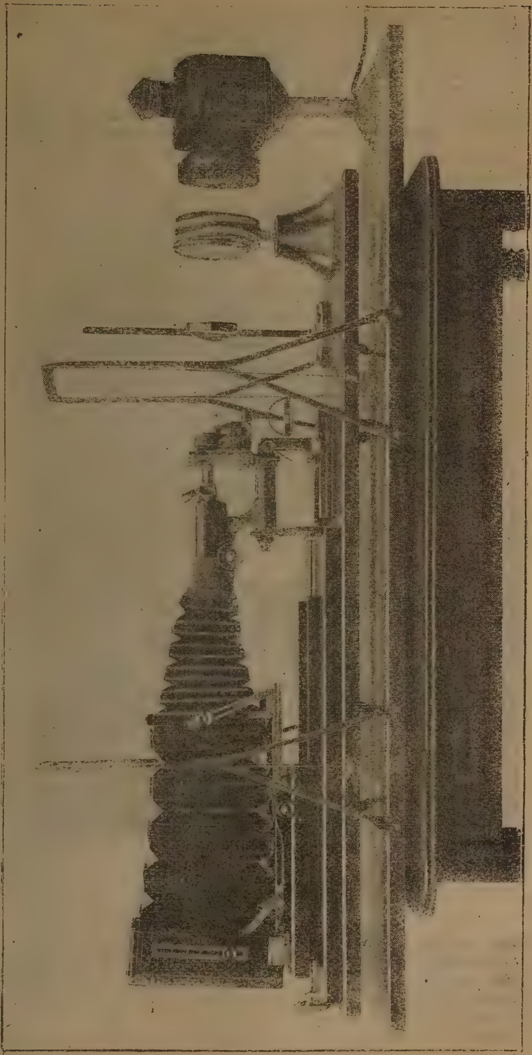


Fig. 1.—Side View of Swinging Stage.

strength. One-inch planks were used throughout to ensure rigidity. The boards were coated with mahogany varnish to give a better finish to the apparatus. The base-board is 4ft. 6in. long and 12in. wide. An increase of an inch or two in the width would be an improvement, as more room would be allowed between the uprights for the swinging stage. The swinging stage is 3ft. 9in. long by 10in. wide. Above the stage another piece of wood about 2ft. long is fastened. Along this plank run two rails; these rails allow the camera block to be moved to and from the camera. The camera base-board is screwed to a short board or block which is provided with runners to fit the rails. The block and rails allow the camera to be drawn away from the microscope when the object is to be examined through the eye-piece. The usual method adopted for moving the camera away from the microscope, by turning it on a pivot, is not practicable in this case, as the position of the iron sup-

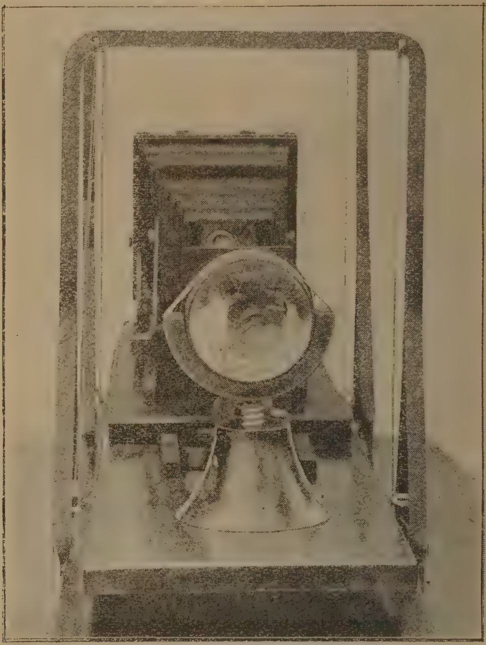


Fig. 2.—End View of Swinging Stage.

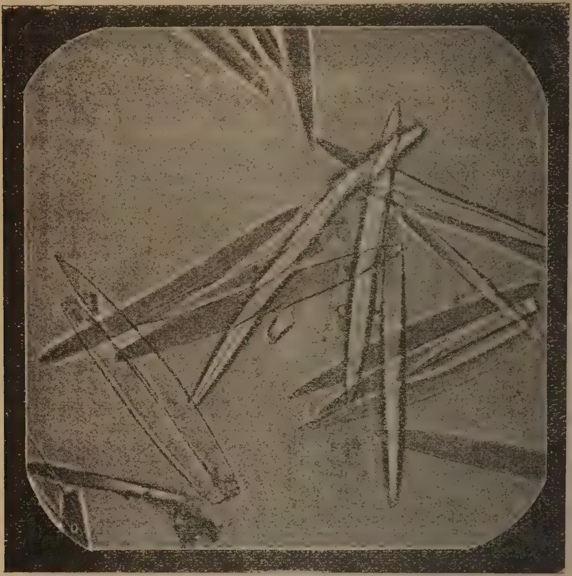
ports will not allow the camera to be swung round. The uprights or struts are made of wrought iron (¾ by ¼in.), and are 18in. in height, with a span for the swinging stage of 12in. (this allows the stage about 2in. play). The uprights are strengthened by the addition of pieces of iron, forming angles with the struts about half-way up the supports. The struts are fastened to the sides of the base-board by screws. The struts and rod with grooved wheel for turning the fine adjustment are about the only parts of the apparatus that need be purchased. Fig. 2, giving a front view of the staging, shows the manner in which the stage swings between the supports.

The stage is swung from the supports by catgut violoncello strings, which make very efficient suspenders. It is necessary to have reliable suspending cords, as the weight of the staging, microscope, camera, and accessories is considerable. The writer first used ¼in. rubber cord, but found it worse than useless; the thick 'cello strings, however, answer admirably. The string is fastened through a hole in the top of the supports and secured to the swinging stage by what is known as a screw-eye. If the string requires tightening or loosening the screw-eye is turned as required. Large screw-eyes are necessary, or there will not be enough screw threads to allow the strings to be properly adjusted. When the 'cello strings are being fastened, the swinging stage should be raised an inch or so higher from the base-board than will be ultimately required, in order to allow for the catgut "giving" when the microscope, etc., is placed on the stage. The movable condenser stand in the illustration is made of whitewood; a screw running down the block enables the condenser to be raised or lowered. The condenser is kept in position by rubber bands. The metal rail and saddle for focussing the condenser that is now in general use is too heavy for a swinging stage.

It will be noticed in the illustration that the lamp is placed on the base-board and not on the swinging stage. This is to prevent the gas-pipe from communicating vibration to the stage. The lamp is an ordinary lantern lamp placed on a stand, and is constructed for two incandescent gas-burners, the Welsbach mantles being placed close together. The writer intended fixing a support to steady the camera when focussing (of course removing it before exposing the plate), but found the swaying of the camera caused very little inconvenience in the preliminary operations. The camera used is a half-plate instrument with an extension of 30 inches. The microscope used by the writer is one of Ross's, and is fitted with a reversible foot. This reversible foot is very convenient for photographic work, as it preserves the balance of the instrument and ensures rigidity when the microscope is used in a horizontal position. The swinging apparatus in the illustration is designed for portability, and is intended for use on a bench or table. In this form it takes up comparatively little space. If constructed for a laboratory or large studio the base-board should be much heavier, and provided with legs.

The illustration, Fig. 3, shows a photograph taken with the swinging apparatus. The slide is a group of spicules. The photograph was taken through an ⅛ objective (dry). The exposure (20 minutes) was purposely lengthened in order to give the apparatus a thorough test. Trains were frequently passing within a few yards of the camera, and persons were moving about in the same room, but it will be noticed that the image is quite sharp and the edges of the spicules well defined.

There can be no question that a swinging stage is far better than the solid base-stand for studios where vibration is found to be a hindrance to good work. When photo-micrography has to be carried on near a street with a heavy vehicular traffic, or in a laboratory with dynamos in the basement, the swinging stage will be found to obviate all difficulties caused by vibration. The form of apparatus described here is not put



$\frac{1}{8}$ in. obj.

Fig. 3.—Spicules. Halichondria Simulans.

forward as a complete model. It is, however, easy to construct, portable, and easily worked. Those microscopists who are troubled with blurred negatives are strongly advised to give the swinging stage a trial. J. I. Pigg, F.R.M.S., F.R.P.S.

THE ACTION OF AMMONIUM PERSULPHATE ON THE PHOTOGRAPHIC IMAGE.

The question has often been discussed whether the reducing action of persulphate of ammonia is most vigorous in the densest parts of the negative, while having less effect on the thin portions of the image, or whether the dense and thin parts of the negative are equally reduced.

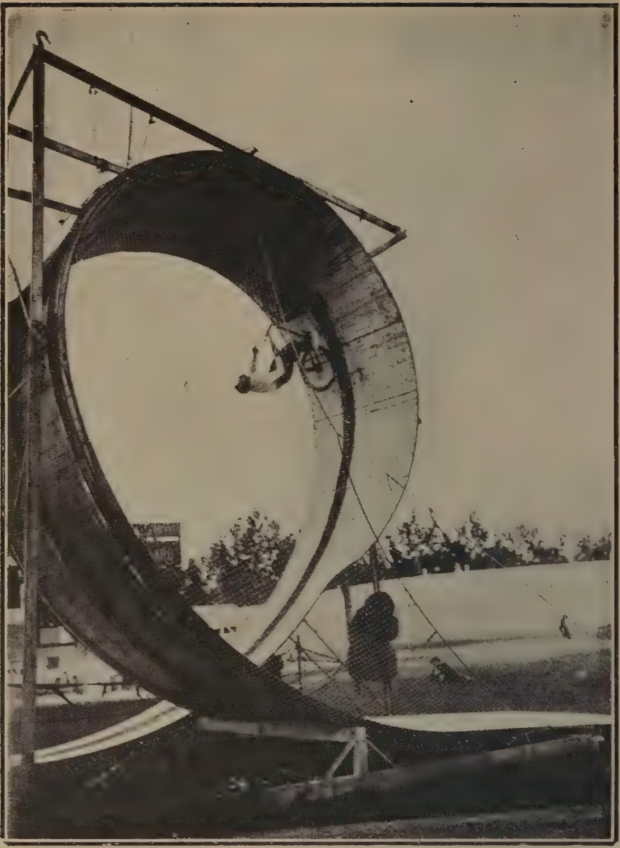
THE REHEARSAL.

Taken with the

Goerz-Anschutz Folding Camera

. . and . .

Goerz Double Anastigmat.



"LOOPING THE LOOP."

Taken in $\frac{1}{1000}$th second with the

Goerz-Anschutz Folding Camera

and

Goerz Double Anastigmat.

The advocates of persulphate of ammonia claim that a harsh negative can be softened by reduction in ammonium persulphate, but several writers have disputed this theory, and endeavoured to prove that the gradation of the image remains unaltered by the persulphate.

Of course, when a negative is reduced by the ordinary methods, ferricyanide of potash and hypo, or the cyanide of potash and iodine reducer that is used by wet-plate workers, the thinner portions of the image disappear almost before the solution has begun to act on the densest parts of the plate. In consequence of this effect of these reducers, they cannot be used for negatives that have the least tendency to hardness.

It occurred to the writer that the question of the actual amount of reduction, both in the dense and weak portion of the image, that takes place in the silver deposit, might easily be determined by observing the action of the various reducers on the silver granules through the microscope. A half-tone screen negative (wet plate) was selected for the purpose, as with a screen negative it is easy to secure a comparatively large portion of film, in which the half-tone "dots" are of exactly the same size, shape, and density over all the surface of the film that is used for investigation. The "dots" of the screen negative vary in density

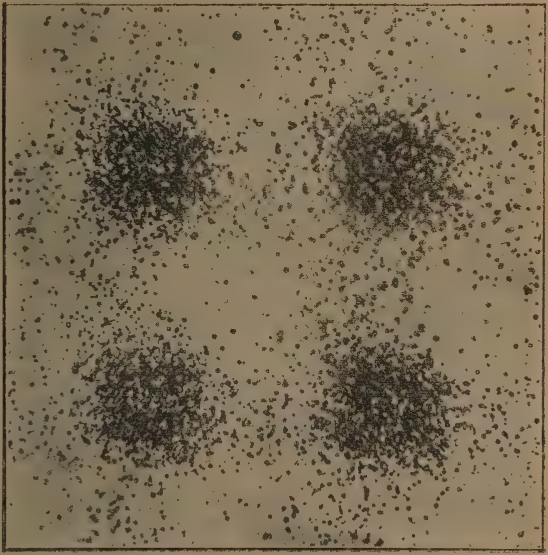


Fig. I. + 250 diameters.

Photo-micrograph of half-tone screen negative before reduction.

from opacity in the centre to a few isolated grains of silver at the edges, and this feature of the half-tone negative made it eminently suitable for studying the comparative reduction of both the dense and thin portions of the silver deposit. A comparatively high power is required to render the structure of the silver deposit plainly visible; in this case a ⅛in. objective was used for both observation and photographic purposes. The effects of the various reducing agents are given in Figs. I.-IV.; in each case a group of four dots were photographed, and in all portions of the film used for investigation the "dots" before reduction were identical in size and density.

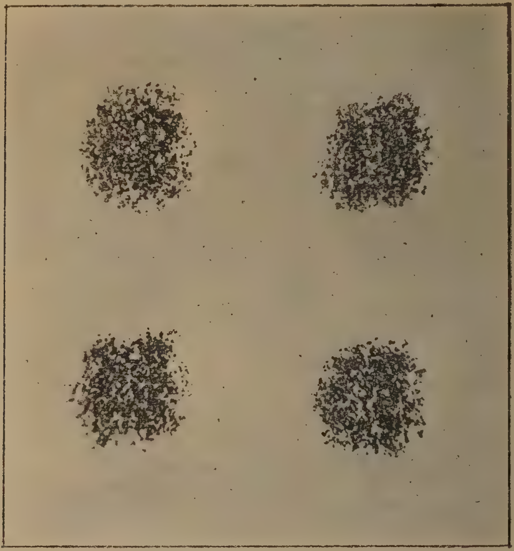


Fig. II. + 250

Photo micrograph of Negative after reduction by Ferricyanide of Potash and Hypo.

The first illustration (Fig. I.) is from a photomicrograph of the "dots" as they appeared after development, and before being reduced. It will be noticed that in the middle of each "dot" there are several opaque patches, but round the edges and in the space between the dots only isolated granules are to be seen. The dots in this photograph, as in all the other illustrations, have been magnified 250 diameters. Fig. II. shows the appearance of the dots after reduction by ferricyanide of potash and hypo. The film remained in the reducer for four minutes. The photograph gives the results that would be expected by those who are familiar with the action of the ferri-hypo reducer. The dense deposit in the centre of each dot remains practically unaffected, while the isolated granules of silver at the edges have all been removed.

The illustration proves that the reducer acts on the weak portions of the negative with far greater rapidity than on the denser parts, and explains the "hardening" effect of this reducer on the photographic image.

Fig. III. is a photograph of a portion of the film after partial reduction by cyanide of potash and iodine. This method is in general use with wet-plate workers, and for wet collodion negatives it is a beautifully clean and reliable reducer. In this case the reduction was not carried so far as with the ferricyanide and hypo-reduced film (Fig. II.), in order that the photograph could be taken before the isolated granules had been entirely removed. It will be seen that the action of this reducer on the image is exactly the same as that of the ferricyanide solution, the dense parts of the silver deposit are unaltered, while the scattered grains of silver have nearly all disappeared. Fig. IV. is a photomicrograph of a portion of film reduced by ammonium persulphate. It will be seen at once what a great difference there is in the action of persulphate of ammonia on the

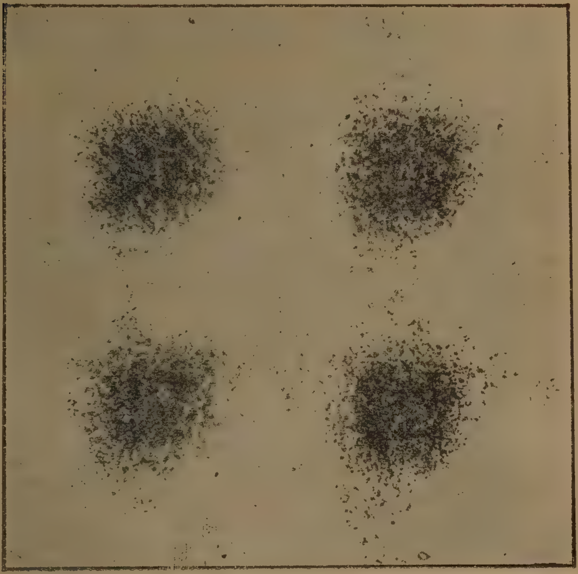


Fig. III. + 250

Photo-micrograph of Negative after (partial) reduction by Cyanide of Potash and Iodine.

silver granules as compared with the other reducing agents. In this case the centre of each dot has become permeable to light, and there are no opaque patches left as in Figs. II. and III. The isolated grains of silver surrounding the dots have become smaller, but are not reduced in number. It is evident from the small size of the granules in the centre of the dot as compared with the size of the scattered particles at the edges that the most vigorous action of the reducer has occurred in the densest parts of the image, although, of course, reduction has taken place all over the film. In all the "dots" of the portion of film reduced by ammonium persulphate that were examined under the microscope the reduction was greatest in the densest parts.

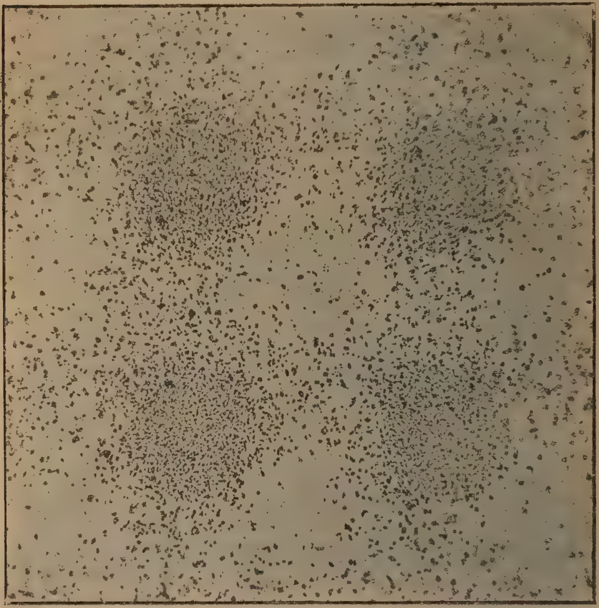


Fig. IV. + 250

Photo-micrograph of Negative after reduction by Ammonium Persulphate.

In order to give a still further test of the ability of isolated granules to withstand the action of the persulphate, a piece of film was reduced till the silver had been nearly all removed from the collodion, but as long as any portion of the centre of the dots remained the isolated grains were to be found round the edges.

There can be no question that denser portions of the negative are more susceptible to the action of ammonium persulphate than the thinner parts of the image. When a film reduced by ammonium persulphate is examined under the microscope it is evident that besides reducing the size of the silver grains the chemical has altered the character of the deposit. The silver granules after reduction by ferricyanide-hypo or cyanide-iodine remain opaque, but with the ammonium persulphate reducer the granules become opalescent. This effect on the silver granules of the persulphate must have the result of still further increasing its power of reducing hardness in negatives. The reducing action of ammonium persulphate is very much slower than that of ferricyanide and hypo or pot-cyanide and iodine. Although the film was immersed in a saturated solution of persulphate, the time required for the reduction of Fig. IV. was three times that given in Fig. I.

J. I. Pigg.

RECENT NOVELTIES IN APPARATUS, &c.

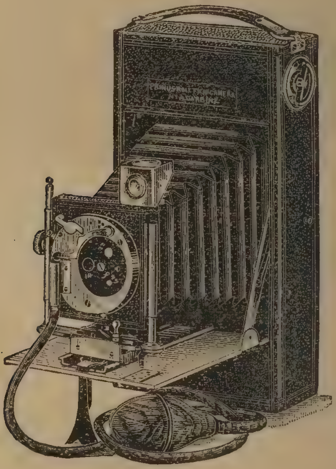
By the Editor.

[*These notices are confined as far as possible to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.*]

PRIMUS ROLL FILM CAMERAS.

(Sold by W. Butcher and Sons, Camera House, St. Bride Street, London, E.C.)

The first of these cameras is styled the No. 2 Pom-Pom, which takes a photograph 2½in. by 3½in. Closed up, the instrument measures 7in. by 3¼in. by 1¼in., so that its portability is obvious. It is neatly covered in grained leather, and the fittings are of bright metal. Time and instantaneous exposures may be given, and the diaphragm plate has three apertures; a focussing scale in the baseboard and a reversible finder are other features. The lens is a single combination. The spool chambers are fitted with removable metal holders for the spools. The little instrument is strongly constructed and well-finished, and at the low price of

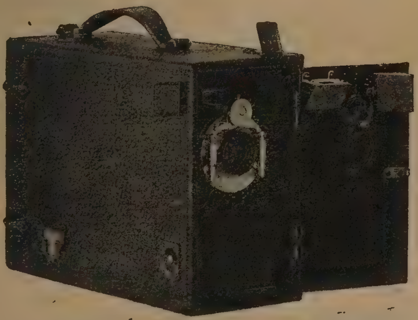


£1 1s. is excellent value. The larger of the two machines before us is the No. 2 Carbine, for quarter-plate photographs, and retailing at £2 2s. Closed, this measures 8¼in. by 4⅛in. by 1¾in. Covered in grained leather, the bright metal fittings give the camera a handsome appearance. A rise of front is obtainable. A revolving flange on the lens front gives apertures of f11, f22, f44; the movement of a knobbed lever at the side of the disc shown in the illustration controls the exposure for either time or instantaneous. The camera has a reversible finder, a focussing scale, and a single lens, as well as the convenience of detachable spool holders.

THE QUARTER-PLATE "CYKO" CAMERA.

(Sold by John J. Griffin and Sons, 20-26, Sardinia Street, Lincoln's Inn Fields, W.C.

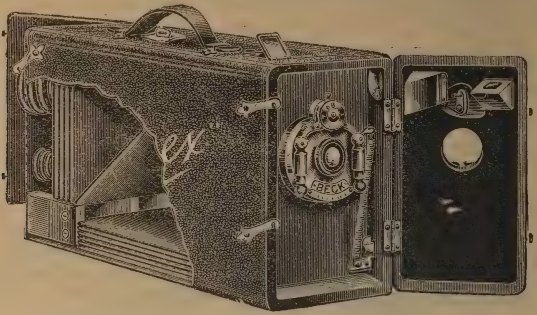
The special features of the R.R. "Cyko," as the quarter-plate instrument before us is termed, include a Beck Rapid Rectilinear lens, working at f8, fitted to a Unicum shutter, giving speeds ranging between 1sec. and a hundredth. Set in the baseboard of the camera is a revolving arm actuating a disc immediately under the magazine, which it moves either in an anterior or posterior direction as may be desired. The practical effect of this is to convert the machine into a focussing or a fixed focus camera at will. The scale of distances is shown at the side. The R.R. "Cyko" is covered with embossed leather, and it takes plates in sheaths, the changing being effected by the mere side to side movement of a milled head on the top of the camera.



THE MODEL D "CORNEX" CAMERA.

(R. and J. Beck, Limited, Cornhill, London, E.C.)

Messrs. Beck in this camera have replaced the rack and pinion focussing motion by a direct cam action movement, which works very smoothly, and has not the same amount of back lash and does not show the same amount of wear as the older mount. When focussing, the plates are moved and not the lens; this action, combined with the well-known "Cornex Index," provides one with an accurate and rapid means of focussing. The camera is leather covered; the shutter is the "B. and L." Standard Unicum for time, bulb, and instantaneous exposures of 1, ½,

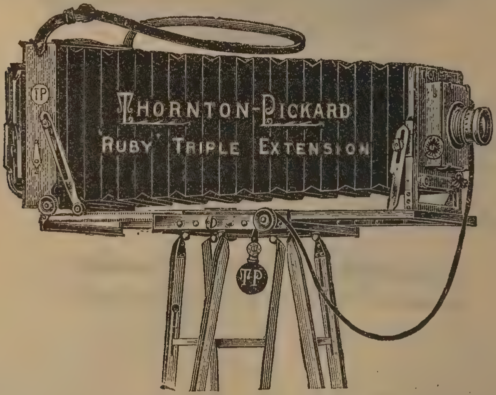


1-5, 1-25, and 1-100 of a second; the finders are "brilliant" with spring open covers; the changing movement is strong and certain, while the lens is a Beck symmetrical, with an aperture of f8.

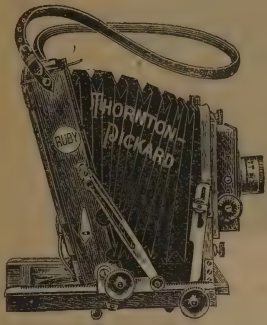
THE "RUBY" TRIPLE EXTENSION CAMERA.

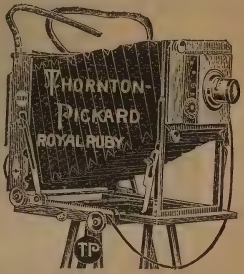
(Manufactured and sold by the Thornton-Pickard Manufacturing Company, Altrincham, Cheshire.)

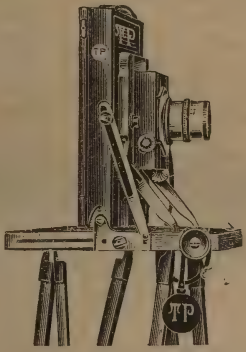
Two of the movements of this instrument consist in controlling the rising and falling front by rack and pinion, and also of actuating the



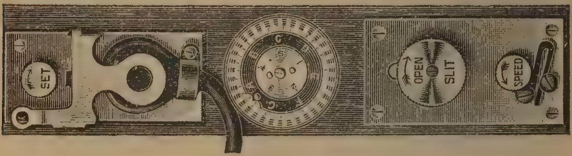
cross front by the same simple agency. Those of our readers who have been in the habit of making these movements of the lens front by simple hand pressure will not need to be told that the substitution of a sweetly working rack and pinion as the motive agency will afford very great convenience indeed in practice. These novel points in construction are supplemented by others; thus, the front swings in either direction, backward or forward, and not only has the camera back the same double swing movement, and in wide angle work, instead of being pushed forward, is also moved to and fro on the baseboard by rack and pinion. A refinement of the triple-extension movement has also been devised, which evidences great thoughtfulness on the part of Messrs. Thornton-Pickard, in obviating confusion in the minds of users of the camera. The two extensions for ordinary use, that is, for the outward extension of the front and the movement for the back, are controlled by rack and pinion from the *right* hand side of the camera; the triple-extension rack is so placed on the left hand side of the instrument, that the photographer is not likely to use it in mistake for the wide angle movement. The turntable fitted to the baseboard is made entirely of brass, is light and rigid, and has projecting rounded brass-knobs, so that when the camera is







set on a table for copying or other purposes it will not scratch the surface. We are here referring, as indicated by the heading to this notice, to the camera with triple-extension; there is another form, termed the "Royal Ruby," having all the same movements, minus this triple-extension. Both cameras are fitted with the ordinary standard pattern behind lens time and instantaneous shutter, fitted with time exposure valve, suitable for general all-round work, giving in the half-plate size instantaneous exposures up to 1.80th of a second, short time exposures of from $\frac{1}{8}$ to 3 seconds, and prolonged time exposures of any duration. The cameras can also be fitted with the focal plane shutter, giving exposures from 1.30th to 1.1000th of a second. The focal plane shutter fits on the camera in place of the ordinary reversing back, and can readily be detached from the camera when required. All movements in connection with the focal plane shutter, including regulation of width of slit, are effected from the outside by simply turning a knob. By means of an attached strap which goes round the neck, the "Royal Ruby" cameras can be used without a stand.



THE ENSIGN-VIDIL FILMS.

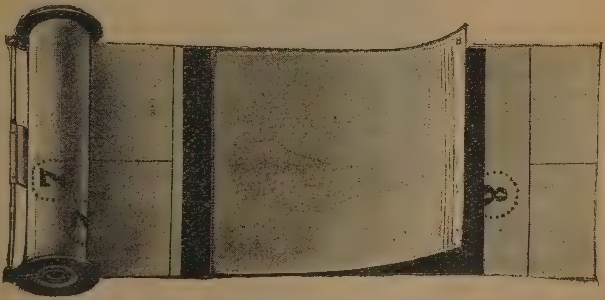
(Wholesale Agents: G. Houghton and Sons, 88 and 89, High Holborn, W.C.)

The registered trade mark Vidil-film indicates that Fritzsche's patent packing system is the emthod employed, while the additional word "Ensign" indicates that the sensitive film itself is the well-known "Ensign Film" made by Austin Edwards. For delivery to the public each roll of film is enclosed in a tin case of triangular shape and distinctive appearance. In removing the roll of film from its case it is found that the film is wound on a spool of a similar kind to that usual with daylight loading films, but that there is an additional attachment to the spool, consisting of a spring clip for the purpose of preventing the film from unwinding or becoming loose during its use in the camera or roll holder. This attachment does not occupy sufficient space to prevent

"Ensign" Vidil-Film Complete in Metal Case.

its being fitted into any of the models of cameras taking film now on the market, and no inconvenience arises from its presence in inserting or removing the film. The important departure, however, is in the arrangement of the film itself and its protecting band of paper. In the ordinary roll film a continuous length of film is backed with a continuous length of black paper, sufficient of the black paper being left beyond each end of the film to form a protection from light to the film while inserting and withdrawing it from the camera. In the Vidil-film the protecting ends of backing paper are provided in the usual way, but the film itself is not in a continuous band, but is divided into sections, each section constituting an independent film the size of the negative for which the camera is constructed. Nor is the black backing paper continuous, for, with the exception of the protecting ends, it is made up of alternate sections of a translucent paper and black backing paper, each section of black backing paper being faced with a section of sensitive film, the first section arrived at when the spool is in the camera, and being unwound being a section of the translucent paper. The object of this arrangement is obvious. The film being in position in the camera, is unwound until the first section of translucent paper occupies the place of a focussing screen, the purpose of which it serves by showing a full sized image of the subject to be photographed and allowing the exact focus to be obtained. For convenience of composing the picture each focussing paper is marked with cross lines. After focussing the camera back is closed to prevent access of light to the interior of the camera through the focussing film, and the winding of the film is continued until the sensitive film is in position and the exposure made. Further winding brings another focussing screen into position, then another sensitive film, and so on, until the whole number of films is exhausted. The

AFTER THE REMOVAL OF THE METAL CASE.



SPOOL OF FILM PARTLY UNWOUND.

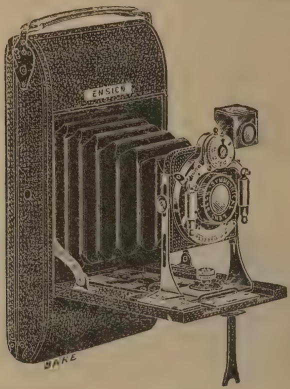
simple method of providing the means of focussing each picture constitutes, undoubtedly, an advance in roll film photography which hitherto has had the drawback that it is necessary to rely upon a finder for arranging the picture, except in a few cases where a troublesome method exists of removing the whole of the film containing part of the camera, and fitting an independent focussing screen.

It is not, however, only with regard to its facility for focussing that the new system deserves mention. As each film is separately attached to the band of protecting paper, it is not necessary to break the continuity of the band in order to develop any one or more of the films, but, in the dark-room, each film is separately removable from its protecting support without interfering with the band as a whole. Thus, for example, if four exposures only have been made on a spool containing twelve, the receiving spool can be taken out, the four exposed films detached, and the band re-wound on the receiving spool. When it is replaced the remaining films are ready for use without further adjustment.

THE "BRITISH ENSIGN HAND CAMERA," MODEL E.

(Manufactured and sold by Geo. Houghton and Son, Ltd., 88 and 89, High Holborn.)

This camera is, we believe, the first of its type to rely mainly, if not quite entirely, upon British workmanship for its production. Its principal features may be thus briefly summarised:—In shape it is flat at the back, with a half-rounded front. It will be seen by the illustration that to a falling baseboard and extending front it adds the convenience of a rising front. An infinity catch fixes the front when drawn out at the proper focussing distance. A novel focussing scale shows at a glance what distance is most sharply focussed with the larger stop, and at the same time gives the range of distance which would be in focus when using either of the smaller stops. A plate attachment with focussing screen admits of the use of single metal slides, for either plates or films. Constructed of mahogany, with red leather bellows, the instrument has nickel fittings inside and oxidised outside. The lens is Beck's symmetrical working at f/8. The shutter a Bausch and Lomb. The "British Ensign," it need

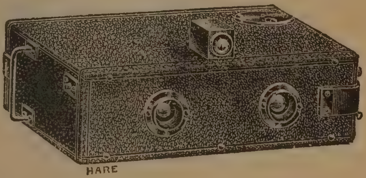


hardly be said, takes daylight loading roll films, and the quarter plate sells for £3 12s. 6d.

SMYTH'S ROLL FILM STEREOSCOPIC HAND CAMERA.

(Sold by George Houghton and Son, Ltd., 88 and 89, High Holborn, London, W.C.)

The little stereoscope is made in wood, of the "Holmes" pattern without the hood, weighing two or three ounces, measuring a few inches each way, and with the oculars separated by a little over 2¼in. Mounted on cards are stereoscopic prints about 1½in. square each, and with a foreground separation of 2¼in. These little prints, when viewed in the tiny stereoscope here described, and illustrated below, are perfectly and satisfactorily stereoscopic. The negatives were made on roll film in the camera shown in the larger of the two illustrations. What it is that deters modern amateur workers from taking up binocular photography in much larger numbers than is the case is perhaps not easy to say offhand; but surely the price of the necessary apparatus is not an obstacle. The little instrument before us costs only one guinea. It is only 2in. in thickness, and when loaded with film weighs 24oz. Single pictures may be taken in the camera by means of a cap covering one of the lenses. The latter, though of the single variety, work at 7.7. The shutter gives time instantaneous exposures, and the camera, which has a sunk ground glass view-finder, is covered in waterproof material. The same type of camera, in a slightly more elaborate form, is adapted for glass plates, sheaths being provided for that purpose. This sells at two guineas, and includes the stereoscope; it is covered in real leather, and has a direct-vision view-finder.

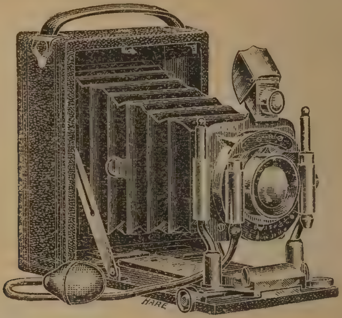


THE FILM PACK.

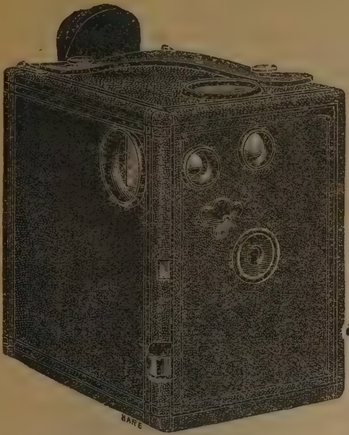
(Sold by the Rochester Optical and Camera Co., 112-113, Fore Street, E.C.)

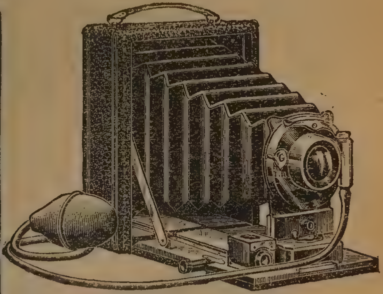
The Film Pack is a system of using cut films, by daylight loading, in the Premo cameras (of the box or folding form), two of which are illustrated in this notice. The Film Pack consists of a light tight sheath made of black press board, with an opening in one side corresponding in size to the exposure, into which are folded thirteen strips of black, chemically pure paper, with the tabs protruding; each of twelve of these pieces of black paper has fastened to the inner side a sheet of film; the tabs which protrude from the sheath are numbered from one to twelve; the thirteenth strip of the black paper is marked "Safety Cover," and does not carry any film, but is folded outside of film No. 1, thus protecting it.

In operation, the Film Pack, in its adapter, is placed in its plate camera, just as a plate holder. The marked black paper flaps protrude slightly. The operation of changing is confined to pulling out one by one the black paper flaps and tearing them off. Whether used in a film camera or in a plate camera, the operation is the same. Successive films are presented for exposure by pulling out one by one the numbered black paper flaps. When the exposures in the Film Pack have been exhausted, the pack is then rendered light tight, and may be taken from the camera in daylight to be replaced by a fresh one. The Film Pack adapter, which resembles the ordinary plate holder in appearance, is used to adapt the Premo Film Pack to plate cameras. It is made with a metal back, and opens like an English book holder. Two metal fasteners hold the back and front together. The front has a slide and corresponds very closely in appearance and operation to the plate holder ordinarily used in the camera. In use the pack is placed in the adapter, the back of which opens, and the adapter is then inserted in the camera exactly as a plate holder. When exposures are to be made the slide is removed. The label on the face of the film pack is broken. The black tab marked "safety cover" is pulled out and torn off. The first film in the pack is then presented for exposure. Successive exposures may be made by repeating the operation and pulling out the black paper tabs one by one and tearing them off. At any time the slide may be returned to the adapter and the adapter removed from the camera. The camera may then be focussed by the use of the ground glass, and if it is desired plate exposures may be made, or the film pack may be returned to the camera and the film exposures continued.



One of the new series of cameras especially adapted for use with the above described method of film-changing, or alternately for use with plates in dark slides, is the Pocket Premo C., which is adapted for quarter-plate size, and is of the folding type. Externally its measurements are 5½ by 4¼ by 2 inches, and it is therefore not too bulky to go into an ordinary side coat pocket. The base board lets down in the usual way, having a sliding arrangement for bringing the front carrying the lens forward and clamping it into position. A scale of distances is provided, but in addition there is a rack and pinion for focussing when the focussing screen is in use. The base board is fitted with a finder adjustable for either horizontal or vertical pictures, and cross spirit levels. What is known as a "piano" hinge is used for attaching the base board to the bottom, forming a more accurate and firmer connection than is usual. The back of the camera consists of a board, carrying a focussing screen, with hinged cover attached to the body by an arrangement which acts as both springs and hinges and holds the film pack adapter or dark slide in position and up to register when inserted between the back board and the camera body. Accompanying the camera, in addition to the film pack adapter, is a specimen dark slide, which deserves a word of praise for its ingenious construction, its lightness, its dainty appearance, and, not the least, its practical design. Like the film pack adapter, it is



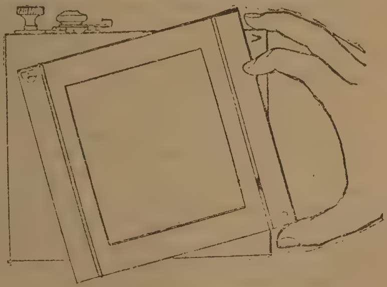


partly of wood and partly of aluminium. The back is for one plate, but it is half the thickness of a double back, and is fitted with a hinged wooden shutter. The whole is beautifully made. The camera is covered with black grained leather, and its metal work is nickel-plated, the interior woodwork being polished mahogany. The lens, which we found on testing to be excellent in quality, is fitted with a shutter adaptable for time, instantaneous or bulb exposures. The camera allows of sufficient extension to focus objects up to about 18in. from the lens.

THE "ADAMS' VIDEX" CAMERA.

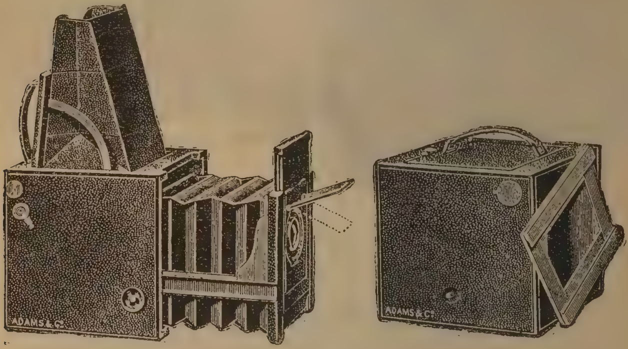
(Manufactured and sold by Adams and Co., 26, Charing Cross Road, London, W.C.)

The latest outcome of Mr. Adams' ingenuity—the "Videx"—has



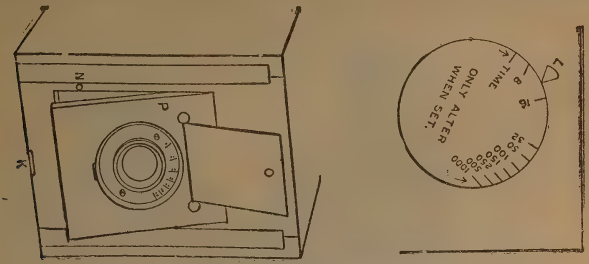
INSERTING THE DARK SLIDE.

recently been submitted to us for critical examination. It appeals to us as emphatically an instrument for professional use. By professional, we are not here referring merely to the photographer whose work is restricted to operating under the skylight, but rather to that large and growing class upon whom the illustrated newspapers rely for the provision of photographic records of daily life. A race meeting, a motor-car contest, the procession of a French President through the streets of London, river scenes, agricultural shows, studies of animals, military and naval reviews, the public movements of the King and Queen, these and a thousand and one other scenes and events are subjected to daily photographic records; and the photographer whose business it is to secure this class of negative needs to be armed with a hand camera upon which he can rely for efficiency of movement to secure certainty of result. The "Videx" is such an instrument.

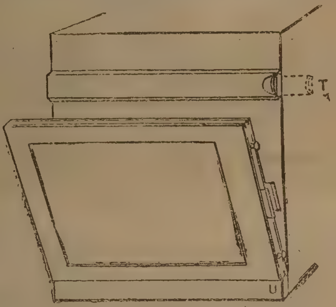


THE REVOLVING BACK.

The main principles which are embodied will be obvious to the student of camera construction. It is in the matter of detail that it requires an attention, the outlay of which will not be regretted by seekers after a first-rate instrument. Take, for example, the flap which uncovers the lens: by a happy thought this is made to do duty as a sky shade. The lens front has a forward movement, and is so easily accessible that either a single lens or a telephotographic system can be readily substituted for a doublet. A drawer in the body of the camera may be utilised for the storage of a single lens, screens, screws, and exposure recorder. The hood, down which one looks at the full-sized finder image, is in one piece, and is fitted to the shape of the face, so that one can exclude all unnecessary light from the image, which is seen sharp and well illuminated. The shutter of the focal plane variety is set externally, and may be driven instantly at any speed, from the 1,000th to the $\frac{1}{8}$th of a second while the plate is in position. The extension movement relies upon metal as the material of construction, the stay shown at the side of the camera running in a metal groove, thus enhancing the strength of the instrument. One of the most valuable characteristics of the instrument is the revolving back: by simple hand pressure this can be made to take a circular movement, and thus the photographer has the enormous convenience in instantaneously changing his plate from the horizontal to the vertical. The camera takes either dark slides, changing boxes or roll film holders. And there is, of course, amongst the other conveniences a rising front.



The Lens Front and Shutter Speed Scale.

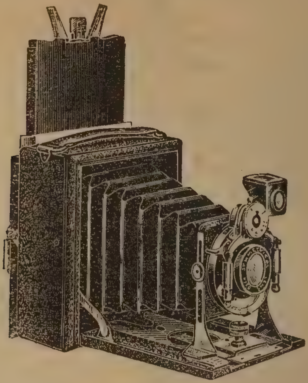


THE RAJAR FLAT FILM CHANGER AND FOLDING POCKET CAMERA.

Manufactured by the Brooks-Watson Daylight Camera Company, Ltd.,
91, Homer Street, Liverpool.

The general action of the Rajar flat film changing apparatus we described in last year's Almanac. During the year the changing back has been greatly improved in outward appearance and finish, and although the mechanism remains substantially the same, it has been perfected in detail. An important improvement is the substitution of a celluloid separator for a metal one, which has entirely removed all danger of scratches occurring on the films in the operation of changing.

The Rajar Folding Pocket Camera, which is made in quarter-plate size, has been specially designed for use with the Rajar changing system, although double backs may be used if desired. It is of the folding pocket type, and when closed is of unusually small dimensions. It is



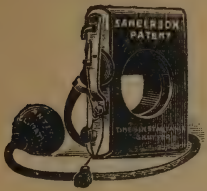
made of well seasoned wood, with screwed joints to withstand tropical climate, and is covered in fine grained solid leather. It has a sliding focussing movement with an infinity catch and a "Cornex" distance scale giving the depth of focus for various apertures. The finder is a rotatory one of the "Brilliant" type, and folds within the camera when closed. The lens, which may be the Beck symmetrical, the Beck double aplanat, the Beck biplanat, or the Beck Steinheil orthostigmat, is fitted with the Bausch and Lomb Unicum shutter. The camera is fitted with a rising and falling front, and the metal work throughout is nickel plated.

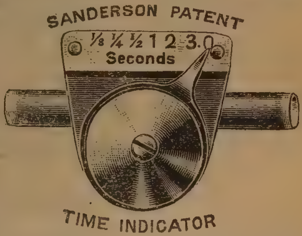
THE SANDERSON NEW MODEL PATENT ROLLER BLIND SHUTTER.

Manufactured by the Altrincham Rubber Company, Grafton Street and Mossburn Buildings, Altrincham.

It is a feature of this shutter that the dimensions can be kept down so that it can be fitted to most small folding cameras. The smallest size shutter measures 2¾in. deep by ¾in. thick and 1¾in. wide, the projections at one side increasing the width ½in. It is constructed for a lens of 1⅛in. or any less diameter, and together with ball and tube weighs 3oz. The shutter may be set for exposures varying from one-fifteenth to one-ninetieth of a second, and is also adjustable for time exposures of any duration. The larger sizes are fitted with a speed indicator, also with a new patent timing device. The following are the instructions for using the shutter:—for instantaneous exposures the pointer is moved downwards towards the word "Inst." For variations of speed turn the knob on the right hand side of the shutter. The various speeds at which the shutter works for instantaneous are recorded on the ivory disc which shows through the round hole in the brass plate on the left hand side of the shutter. To reduce the speed to normal, press the flat brass spring under the speed knob. For time exposure the pointer on the lever of the shutter is moved upwards towards the word "Time." Pressure of the ball opens the shutter, and a second pressure closes it.

Time exposures of any desired length also can be given by simply pulling the cord half way, when the aperture of the shutter remains uncovered as for focussing. When it is desired to close the shutter simply squeeze the ball.





When the special timed speeds are wanted, set the shutter for "time" and place the pointer at any desired speed shown on the ivory plate. Press the ball sharply and retain hold of it. When the pointer is close to the right hand side peg on the plate the shutter can be used for ordinary time exposures of any length.

The special timing device can be supplied separately, and it may be used in conjunction with any make of time and instantaneous roller blind shutter. These shutters have no joints in the wood, being cut from a solid block of mahogany. The speed indicator does not project, and all the mechanism is within the box.

IMPROVED RUBBER GOODS.

Manufacured by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.

The new developing apron and sleeves are made of rubber-faced fabric,

THE NOTED HOUSE FOR PHOTOGRAPHIC RUBBER GOODS OF EVERY DESCRIPTION

THE ALTRINCHAM RUBBER COMPANY
GRAFTON St. & MOSSBURN BUILDINGS ALTRINCHAM.

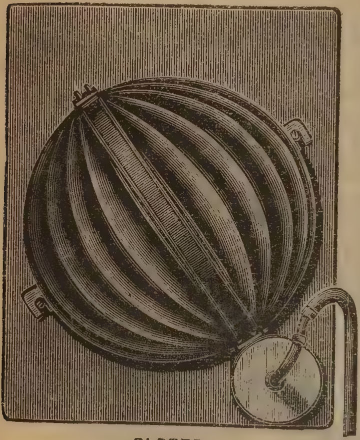
and while quite waterproof are free from stiffness. The sleeves or cuff protectors have elastic ends which fit closely to the wrist and effectually prevent the entrance of liquid. The upper ends are also threaded with elastic and hold sufficiently closely to the sleeves to avoid slipping down. The apron is of ample proportions, and has a bib to protect above as well as below the waist from drops and splashes.

The company have also introduced a new series of accessories for photographic use, such as bulb shutter releases, bulb teats, bellows teats, bellows for studio shutters, tubing, etc, manufactured of a special quality red rubber to withstand perishing owing to the influence of the atmosphere, particularly in tropical climates. These goods are marked "Anti-climatic." The standard pattern shutter release consists of a ball, two feet of tubing, and a teat joined by screw connections, but the series includes the special forms for most of the shutters in general use.

THE SANDERSON STUDIO SHUTTER.

Manufactured by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.

The Studio Shutter is attached to the inside of the camera front behind the lens. When closed it consists of two quarter hemispheres of ted leather, with a light overlapping joint. Upon actuating the pneumatic release the two sections fold back, disclosing the lens. The pneumatic arrangement consists of a strong pear-shaped bulb fitted at the neck with a metal latch for keeping the bulb empty when necessary. For focussing the bulb is pressed and the latch applied; the bulb being thus maintained empty, the shutter remains open. Release of the latch allows the bulb to suck back the air in the shutter bellows and the shutter closes. Seven feet of stout tubing are provided, so that the operator may be that distance from the camera at the time of exposure.



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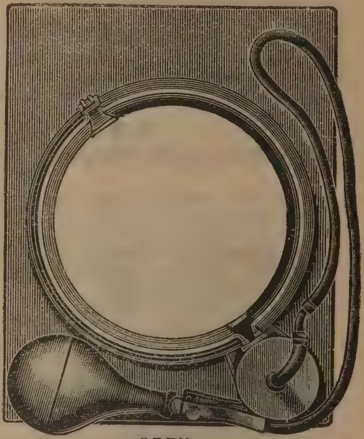
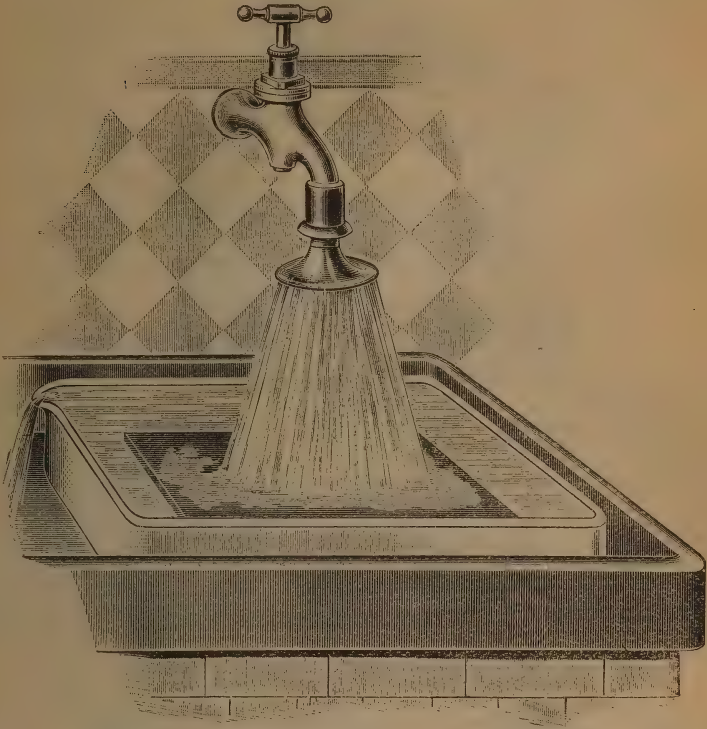


OPEN

DARK ROOM TAP ROSE AND FILTER.

Manufactured by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.

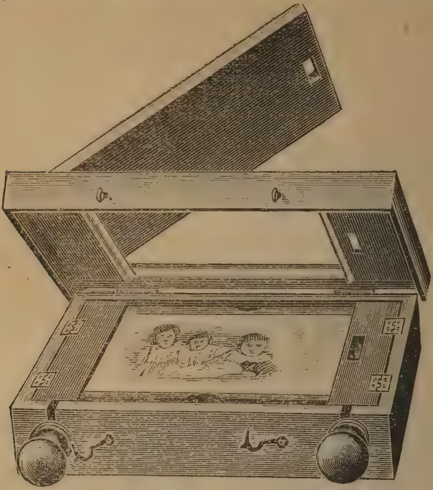
This appliance for the dark room sink consists of a metal rubber-lined cap to fit to the tap, attached to a finely perforated rose. Internally there is a filtering arrangement which removes the grosser impurities of the water without materially impeding its flow. When the rose is not required it may be unscrewed, leaving the filter. The appliance is made in various sizes and to fit round or oval taps.



THE SANDERSON PATENT BROMIDE PRINTING MACHINE.

Manufactured by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.

This apparatus uses a roll of bromide paper, which is wound, in the dark room, on a spool or roller which is placed in the hinged box at the left hand side of the apparatus; the end is then fastened to a receiving spool contained in the hinged box on the right hand side, passing under the negative, which is adjusted as shown. The lid, with its flap, is then

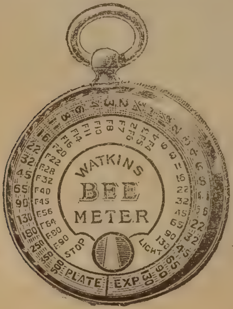


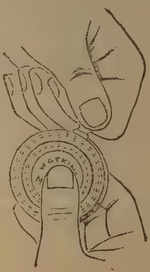
closed and the whole is light-tight. For exposure the lid flap is opened. To change the paper the catches of the lid are loosened and the paper wound onwards. The number of exposures made is shown on an indicator. When not in use for printing the apparatus may be used as a panoramic means of displaying a succession of prints from different negatives made on the same strip.

THE "BEE" EXPOSURE METER.

Manufactured and sold by the Watkins' Meter Co., Imperial Mills, Hereford.

It will be seen by the larger of the two illustrations that the "Bee" is





a watch-shaped instrument. It has a white metal case with snap lid, is 1¾ inches in diameter, and takes the usual disc refills. The smaller of the illustrations shows the way in which the glass is turned by gripping in contact with the back. Here are the essential instructions for the use of the "Bee" meter:—"Grip glass and back together, and set the diaphragm against the plate speed. The exposure will then be found against the light value from sunrise to sunset, without resetting." A booklet and a card of short instructions which are sent out with the instrument are also intended to facilitate the successful application of the instrument.

FIDLER'S AUTOMATIC DIVIDING BACK AND REPEATING PRINTING FRAME.

Wholesale agents: Marion and Co., 22, Soho Square, W.C.; George Houghton and Son, Ltd., 88 and 89, High Holborn, London, W.C.; and J. Fallowfield, 146, Charing Cross Road, London, W.C.

The automatic dividing back is an arrangement that can be applied to any studio camera and most others, and has for its purpose the registration of the position of the dark-slide carrying the plate in such a way that a number of exposures may be made consecutively so that each will occur on the allotted portion of the plate, when a number of different negatives are required of the same plate. Two sizes are at present made. No. 1 takes fifteen "postage stamp" photographs on a quarter-plate, the plate being used horizontally. No. 2 takes eight 2in. by 1½in.

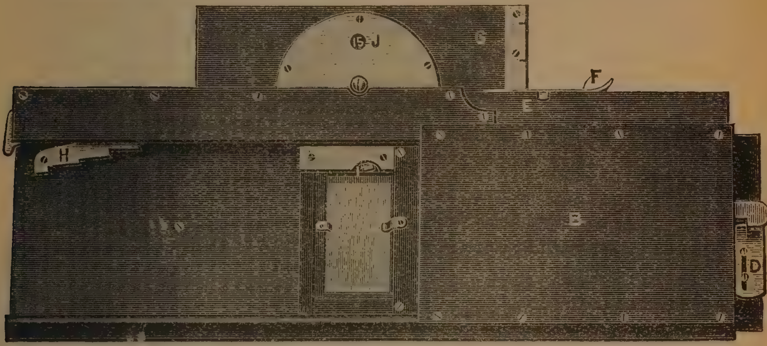


FIG. 1.

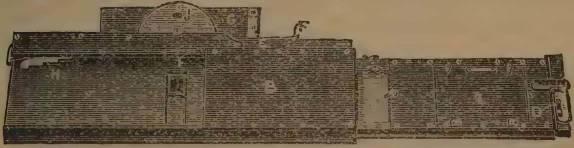


FIG. 2.

photographs on two quarter-plates placed vertically in the dark slide side by side. The general construction is that of an ordinary repeating back, the focussing screen being, however, attached to the end of the dark-slide, so that it is withdrawn as well as pushed forward with it.

Fig. 1 represents the back inserted in the sliding frame, and the focussing screen in position for focussing the first picture. For exposure the focussing screen is drawn to the left until it meets with the stop H, the shutter being held by the bolt D at the right hand side, thus being opened by the act of pulling forward the dark-slide. The picture is made on the top left hand corner of the plate, and its number, in this case 1, is automatically registered on the indicator J. The act of returning the focussing screen to position, by a simple mechanical arrangement, moves the stop plate H upwards so that the second notch comes into position to stop the focussing screen on its second travel. The second time of returning the focussing screen brings the third notch into position, and so on until the top row of five pictures is made, the indicator showing the number of the exposure. After the fifth return of the focussing screen the stop plate returns to its original position, and the horizontal sliding frame requires to be moved upwards in the vertical sliding frame G until the catch F engages its second notch, thus bringing the plate into position for receiving the central row of pictures, and when these are completed another rise of the horizontal sliding frame brings the plate into position for receiving the bottom row of pictures.

If the dark-slide is not removed before the whole fifteen exposures have been made the indicator will be in position to start on the next insertion of the slide with No. 1, but if removed before the plate is filled it is necessary to work the focussing screen backwards and forwards until the number 15 appears on the indicator, which will then register from 1 forward correctly. The whole arrangement may be removed at any period, whether the plate is filled or not, to allow the camera to be used for other purposes.

The repeating printing frame is designed for use in conjunction with the dividing back. It is adjustable to print pictures 1in. by ¾in., 1¼in. by 1in., and 2in. by 1½in., and for all these sizes the paper should be cut 12½in. by 4½in. Fig. 1 shows the back of the printing frame ready for

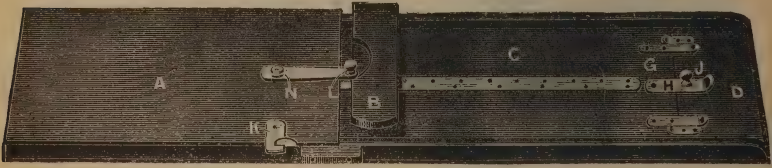


FIG. 1.

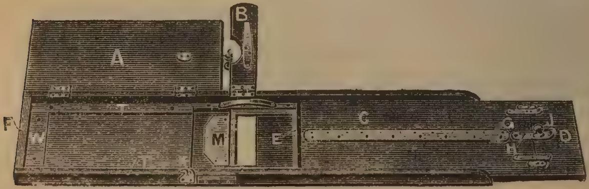


FIG. 2.

making an exposure. Fig. 2 shows interior of printing frame and method of adjusting negative, etc. The directions for use are:—

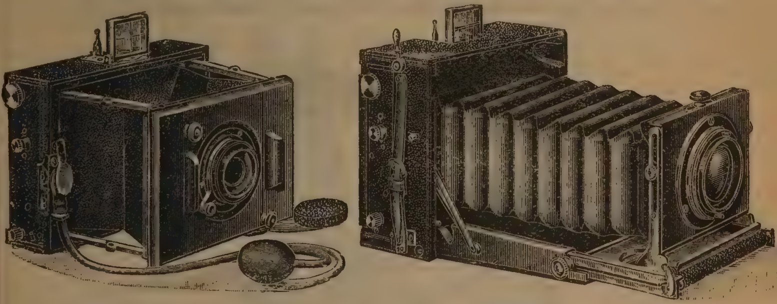
First open flap A and lever B, take out pressure board C and clip piece D, place negative in inner frame E and see that the part of negative to be used is over the opening. Place piece of paper 12½in. by 4¼in. between the guide pieces T T and with one end butted against stopper W, replace pressure board with the back end pressing against the stopper F, turn up about ¼in. of paper at G and slide clip pieces into position to clip the part of paper turned up, fasten catch H to knob J, turn flat A back and fasten catch at K, when the pointer L will register in the first of the dividing holes, next turn over lever B, press home, turn frame up to light, expose, lay frame down again, raise pointer L slightly by knob and draw the pressure board C forward by the knob on clip piece D until the pointer drops into the second hole of divider, press home lever, expose and again raise pointer L, draw forward pressure board. The time taken in printing the sheet is about ten end, when the paper is taken out, the negatives moved forward for the second row of pictures to be over the opening and another piece of paper inserted, and the operation repeated until all the rows on negative have been used.

The size of opening is regulated to suit the size of picture by the plate M, and the pointer L is moved to one or the other of the rows of holes by slackening the nut N slightly and moving spring over and again tightening nut.

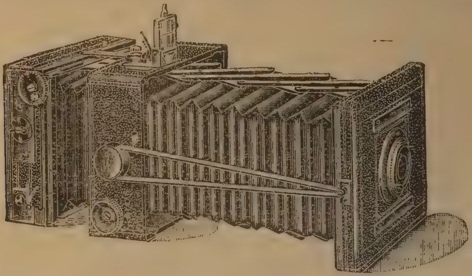
THE VOIGTLANDER CAMERAS.

Manufactured and sold by Voigtlander and Sohn, Ltd., 12, Charterhouse Street, London, E.C.

The appended illustrations show three new hand cameras which Messrs. Voigtlander are placing upon this market. In No. 1, "The Favourite," we see a type which has lately sprung into considerable popularity; it is of the collapsible form, the extended body being held in position by side stay pieces. The focal plane shutter permits of exposures of as little as one 1,200th of a second, and the adjustment of the exposure slit is externally controlled. The lens moves by the actuation of a lever in the focussing jacket, and the camera front has both horizontal and vertical motions. The camera takes double dark slides, the shutters of which are neatly reeded. Beautifully made in dark wood, with aluminium mountings, all the movements of this instrument are easy and sweet, and in practical use it is extremely handy to manipulate. No. 2, "The



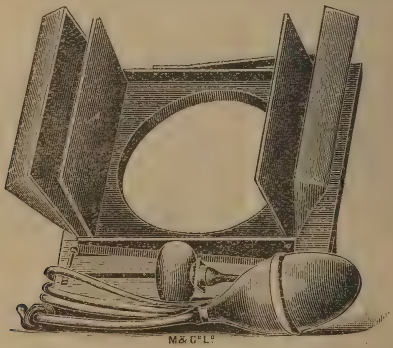
Heliar.' In this instrument it will be perceived that focussing is effected by rack and pinion; as in the case of "The Favourite," it takes a focal-plane shutter, and is fitted with either ordinary double dark slides, or the roller double dark slides with reeded shutters to which reference has been made. No. 3, the "Universal" Camera. This again is a rack and pinion focussing camera, but it takes lenses ranging in foci from 3½ to 12 inches. The focal-plane shutter is removable, thus admitting of the use of other shutters on the lens front. The band shown on the right side of the instrument is scaled off for different foci. The instrument has a hooded focussing glass, and a small reflector placed posterially to the finder shows when a spirit level is perfectly central. The top stays impart great rigidity to the camera. We have examined these three instruments with great interest; when folded up they are extremely compact and portable, and are very light, the quarter-plate in each case being only between 3lb. and 4lb.



THE "NOSOUND" STUDIO SHUTTER.

Marion and Co., Soho Square. W.

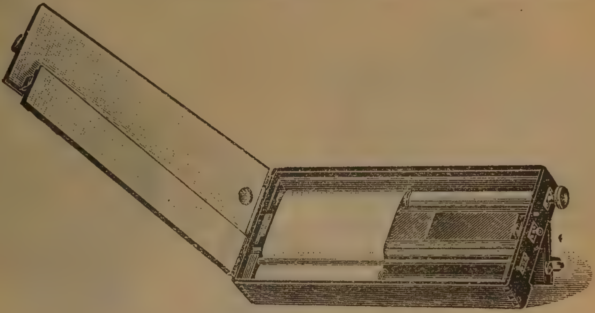
This shutter, which is fitted inside the camera, is extremely simple, not likely to get out of order, and one of the most compact studio shutters made. The one sent us has a 4 inch opening, and measures only 5⅞ by 6⅝ inches outside. Bulb and 6ft. of rubber tube are furnished with each shutter. A metal shut-off to hold shutter open for focussing is also



supplied. The shields or cups at each side form air cushions, which arrest the wings as they open, thus avoiding all rattle, sound, vibration, or dust. Without these the shutter would be worthless. It is made in the following sizes: 2, 2½, 3, 4, 4½, 5, 5½, and 6 inches.

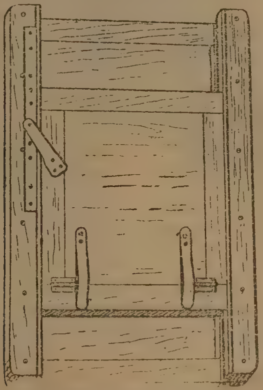
THE APTUS REPEATER CAMERA, PRINTING FRAMES, ETC.

Manufactured by Sharp and Hitchmough, 103, Dale Street, Liverpool.



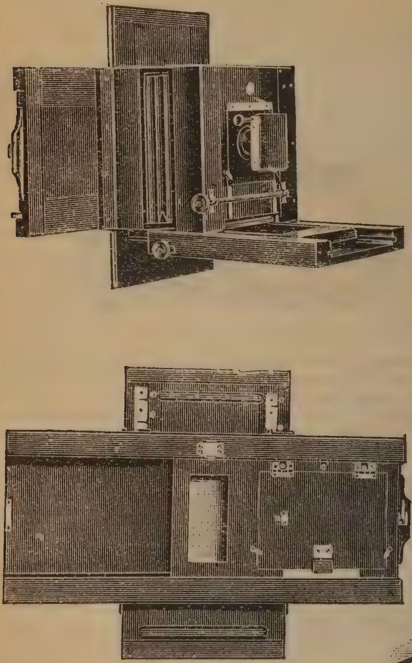
Printing Machine.

The camera is constructed to allow of a number of small photographs being taken on the same plate. The camera itself is fitted with a rack and pinion for focussing, a rack and pinion adjustment to the rising front, and a reversing frame to enable the pictures to be made either vertical or horizontal. The repeating back is provided with a vertical and a horizontal slide, and may be had to make any of the following numbers of exposures on the half-plate—4, 6, 8, 9, 12, 16, or 18. Each number of exposures to be made necessitates an extra slide and fittings.

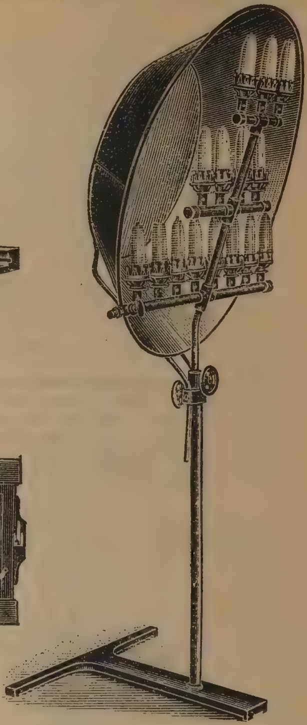


Flat Printing Frame.

For printing the negatives obtained by means of the camera, special printing frames are provided. The No. 2 frame takes a sheet of bromide paper flat, and makes from eight to twelve dozen prints, according to size of picture. The movement of the paper for each successive exposure is effected without the necessity for releasing the pressure board. The time taken in printing the sheet is about ten minutes. The No. 3 printing machine is portable in construction, the dimensions being 16 by 6 by 2½ inches. The paper is wound from one roller to another from the outside. Time required for printing the sheet, about twelve minutes.



Half-Plate Camera showing the Back and Front View.



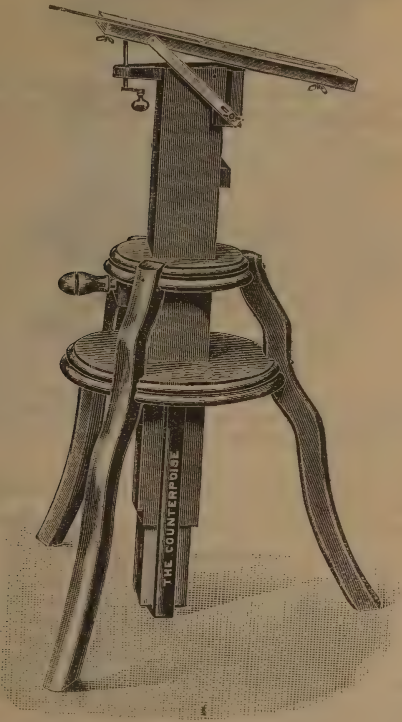
Lighting Apparatus.

The lighting apparatus for taking the pictures at night consists of a specially constructed standard, fitted with fifteen incandescent gas-lights, giving a light of about 700-candle power. The position both of the lights and the reflector is adjustable in every necessary way.

THE "COUNTERPOISE" STUDIO STAND.

Sold by George Houghton and Son, Ltd., 88 and 89, High Holborn, London, W.C.

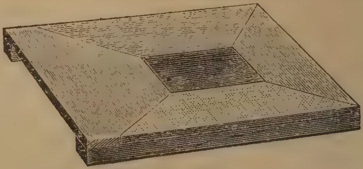
In this modification of the studio camera stand, the weight of the camera and lens is counterbalanced, so that the raising or lowering of the system is facilitated. The table top, it will be seen, is slotted, and to this the camera is attached by a screw nut; hence the camera can be so adjusted that it may always be placed centrally on the table, no matter whether the instrument be fully or only partially extended. This proper distribution of the weight makes for rigidity, and minimises vibration. A brass slotted arm attached to the back of the camera permits of a lateral adjustable movement; it will be seen, too, that the necessary tilting and clamping of the camera can be carried out.

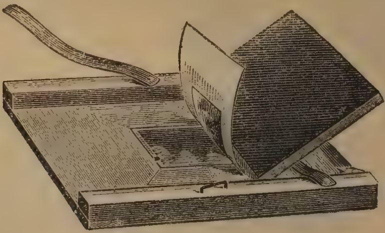


THE "MARRIOTT" POST-CARD PRINTING FRAME.

Sold by Geo. Houghton & Sons, 88 and 89, High Holborn, London, W.C.

The particular points of the piece of apparatus before us are thus summarised: " A rebate is provided in which the plate to be printed from dies and is firmly held in position, and the opening acts as a mask, clean, sharp, and uniform; the post-card can be moved so as to show the picture in any position, and by means of the back, which shows a two-thirds view, the print can be inspected when desired. By using a piece of plain glass of the correct size, roll or flat films can be printed from with the same ease as glass negatives." The frame is neatly and strongly made, well adapted for its purpose, and cheap.

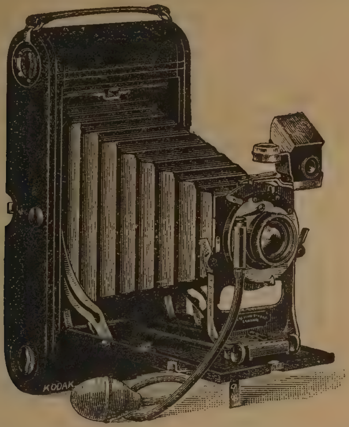




THE No. 3A FOLDING POCKET KODAK.

Manufactured and sold by Kodak, Limited, 43, Clerkenwell Road,
London, E.C.

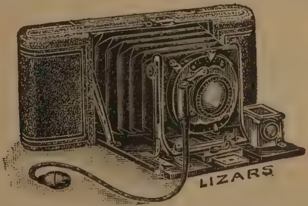
For years past expert photographers have been asking the manufacturers to supply them with cameras taking photographs on plates or films, which are so proportioned in their dimensions as to conform to certain exigencies of what for convenience sake we may describe as "artistic measurement." Let us cite two instances: First, the once popular 7½ by 5, an old favourite of our own in early gelatine days. This size gives you a photograph of which the length is one and a-half times that of the width, and whether you take a landscape, an interior, or an upright portrait, you get a print, which, as regards its proportional dimensions, satisfies your sense of fitness in such matters. So, again, with the 6½ by 4¼, the double quarter-plate, or true half-plate, also a favourite size of our own. Here you get nearly the same conditions as regards measurement as in the case of the 7½ by 5. The size of picture yielded by the new kodak is 5½ by 3¼. We have recently had many opportunities of using the new instrument, and besides being pleased with it on the grounds mentioned, we feel it due to the excellence and finish of its construction to also testify to the ease and practicability of its manipulation. We may note, for example, that the front can not only be raised and depressed, but can also be actuated sideways. Again, the convenience of the photographer is so far studied that the spirit level and finder have a common movement, and reverse together. At full aperture—that is, F8—we found the lens to give a quality of definition which will undoubtedly satisfy the class of worker known as the f64 man. For its size, 9½ by 4¾ by 1⅞, the camera is by no means heavy, being under 2½lbs. in weight. It need scarcely be said that the camera, which takes roll films, can also be adapted for the use of glass plates.



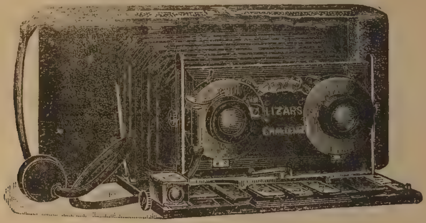
THE "CHALLENGE" HAND CAMERA.

Manufactured and sold by J. Lizars, Glasgow and London.

The Junior B. Dayspool is a roll film instrument, which yields a picture of the size 3¼in. by 2¼in. Its dimensions are 7⅝in. by 3⅝in. by 1¾in., and its weight 16oz. To a doublet lens working at f.8 a Bausch and Lomb shutter, admitting of exposures down to 1-100th of a second, is fitted,



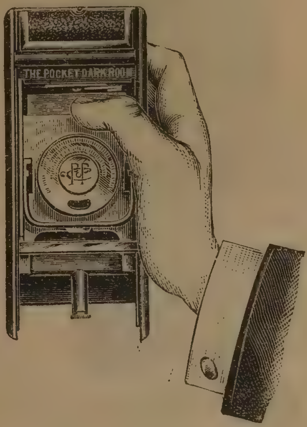
and there is a focussing scale for plates and films. The hinged finder allows of the image being seen both ways. A rise of front is provided. The camera is constructed (with singular neatness and finish) of Spanish mahogany, covered with leather, and the work is first-class. It is a pretty little machine of the pocket variety, simple to use, and attractive to the eye. The "Challenge" model B. stereoscopic camera is the second of Mr Lizars' exhibits. Of this a somewhat full description is appended. The camera is constructed in two forms—namely, with a fixed division in the bellows, and with loose division. With the fixed division, pictures either stereoscopic or lantern slide size ($3\frac{1}{4}$in. square), two on one plate, may be produced, the latter being obtained by capping the one lens and making the exposure with the other. The instrument with the loose division will produce either stereoscopic pictures or, by the removal of the division, the landscape or panel shape, $6\frac{3}{4}$ by $3\frac{1}{4}$. For the landscape size it is necessary to have an extra front panel and a half-plate lens, which takes the place of the stereo shutter, and lenses. The camera is made in finest Spanish mahogany, and has focussing hood and leather bellows. The two shutters are ever set, and are operated simultaneously by one pneumatic or trigger release. The slides are three in number, double, and of the solid form, with aluminium draw-out shutters. The lenses are rapid rectilinear, with Iris diaphragms, controlled by one lever. The camera, it should be said, also takes roll film, and may be used on the stand. It is a well-made, serviceable, compact instrument, having all essential movements for stereoscopic work, for which it is thoroughly well adapted. Such a camera as this should strongly appeal to stereoscopists



THE POCKET DARK ROOM.

Sold by the Pocket Photography Company, Limited, 56, Gracechurch Street, London, E.C.

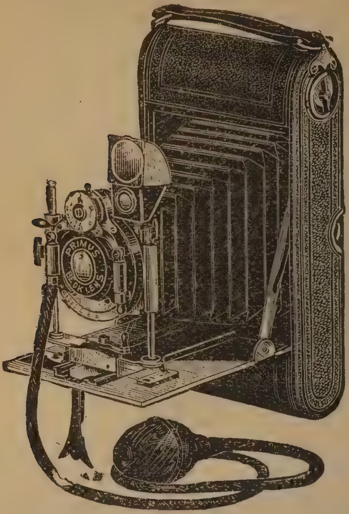
The Pocket Dark Room bears in its external aspects a close resemblance to a small roll-film camera of the folding type. It embodies very considerable constructive mechanical ingenuity. The roll of exposed film having been placed in one end of the little machine, film and black paper may be so guided that they pursue independent courses through the apparatus. The practical advantages of this system are obvious. Through a little window at the back of the machine you may see the particular exposure which you have drawn into your developing chamber, and at the same time what may be described as a separating septum keeps the covering black paper from contact with the film. As you pull the black paper off the spool the film, of course, also moves into the body of the little dark room, and by pressing a rubber-rimmed chamber in contact with it the film is held close and taut in the inside of the machine. Through the little metal opening shown in the cut, the developer is applied by means of a rubber ball, and the Pocket Dark Room can be either rocked in the hand or placed on one side whilst development proceeds. A small piece of ruby glass on the face of the machine allows of the progress of development being observed. When this operation is completed the developer may be poured off, washing water introduced, and the developed film cut off with a knife against a straight edge. To proceed with the development of the other exposures, the black paper is drawn forward in the manner already described, the film, of course, passing between a sheet of red glass and the sheath which separates it from the paper. The instrument is then closed down, the sheath withdrawn, and the developer again introduced into the chamber.

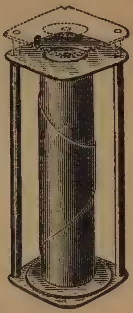


THE No. 4 CARBINE CAMERA.

Manufactured by W. Butcher and Son, Camera House, Farringdon Avenue, E.C.

The camera is of the pocket folding type. The woodwork is in walnut, and wherever possible the metal work is in aluminium to save in weight. The camera is constructed to take either rollable film of any make or plates. A special feature is a new patented Infinity catch. As the register for plates is not the same as that for films in this as in cameras of similar design, the position of the lens in focus for infinity necessarily varies according to whether a plate or film is to be used. To provide for the alternative the new patent catch is a double one, and the camera front may be secured in position for either use equally rapidly and securely. Another important feature is in the fitting of the spool to the camera. A patented spool holder is employed, which is removable from the camera and consists of a kind of cage with an extending end. The spool is very easily inserted and secured, and the spool holder



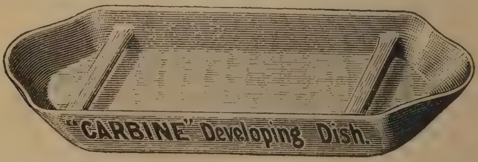


simply slides into a groove in the spool chamber of the camera. This device overcomes the difficulty of having to manipulate the spool into position when the core end fittings are fixed within the spool chamber, or of having a swing core end fitting.

THE CARBINE ROLL FILM DEVELOPING DISH.

W. Butcher and Son, Camera House, Farringdon Avenue, E.C.

The dish is designed to facilitate the development of rollable film in the band by the usual method of passing the band backwards and forwards through the developer. The dish is of porcelain, and is longer for its width than the usual pattern developing dish. Near each end

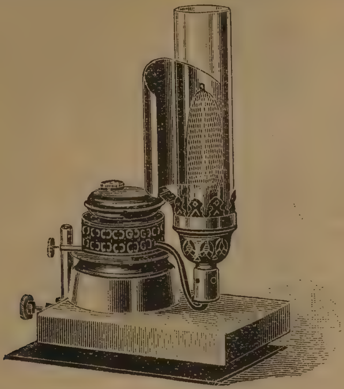


there are straight bridges, leaving about ⅜in. space from the bottom, under which the film is passed. Sufficient developer is used to rise above the bridges, and the immersion of the passing film in the developer is thus assured.

PRIMUS INCANDESCENT LANTERN LAMP.

Manufactured by W. Butcher and Son, Camera House, Farringdon Avenue, E.C.

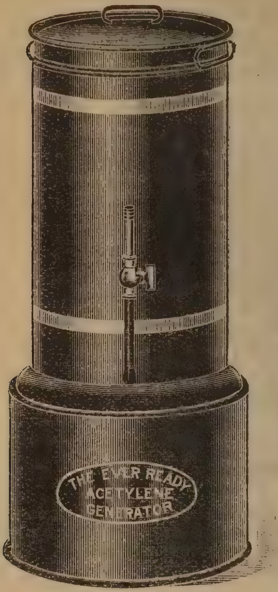
This lamp is an adaptation of the spirit vapour incandescent light, for use in the ordinary optical lantern. The base is a spirit container, which when the lamp is in use, is filled with methylated spirit. A tube containing a thick cotton wick connects the container with and supports the vaporising chamber. The supply of spirit is thus practically regulated. The spirit is vaporised by means of a lighted burner placed under it, deriving its supply of spirit from the container. A tube conveys the spirit vapour to the burner, which acts in the ordinary way by rendering the mantle incandescent. A silvered reflector is provided. The whole apparatus is very compact, and will fit into any ordinary optical lantern.

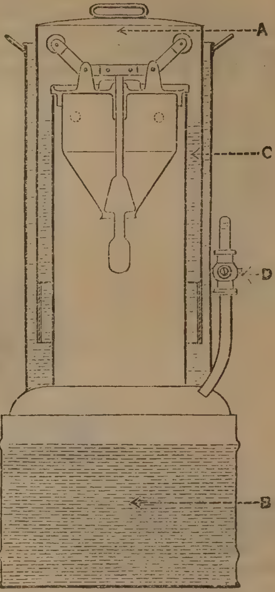


THE EVER-READY ACETYLENE GENERATOR.

ufactured by W. Butcher and Son, Camera House, Farringdon Avenue, E.C.

This is an automatic generator, and consists of an outer vessel containing water, into which the carbide drops to generate the gas, the upper part being double cylinders, the space between containing water to prevent the escape of gas from the gas bell. The carbide, which must be granulated, is placed in a funnel-shaped container having an orifice which is plugged normally with a metal plug, having a rod connected with a lever arrangement at the top of the container. By depressing the lever the plug is raised, allowing carbide to fall through the orifice. While the gas bell is full the plug prevents the egress of the carbide. On emptying, the roof of the gasbell falls upon the levers, depressing them and raising the plug. The generation of gas from the liberated carbide again raises the gasbell, relieves the pressure on the levers, and the plug drops, and so on until the whole of the carbide is used. The directions for use are: Remove the gas bell A and carbide container and pour into B six pints of water; and in the outer chamber C, in which the gas bell floats, water to within one inch of the holes in same. Put one pound of granulated carbide in the container, and make sure (by depressing the lever) that the valve is in proper working order. Now place the container in position, replace the gas bell carefully, and at the same time let the air out of the apparatus gently by partly opening the outlet tap D.



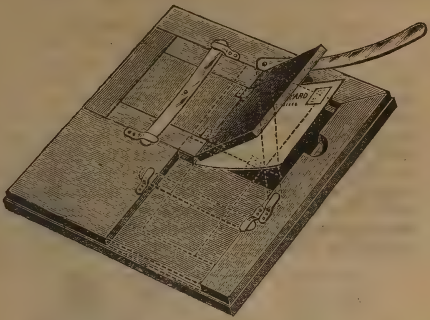


As soon as the bell descends to within one inch of the level of the body of the generator turn off tap D and connect tubing to jet. Now turn on taps of jet and tap D of generator, and as soon as the air is expelled, which takes about one minute, the jet can be lighted. No further attention need be given to the generator, and if during the interval the light is not required turn the gas off at the generator tap.

THE P.C. PRINTING FRAME.

Sold by W. Butcher and Sons, Camera House, Farringdon Avenue, E.C.

The P.C. printing frame can be used for printing postcards from quarter-plate negatives or smaller size film negatives, in any position, either upright or horizontal, the back reversing according to the shape of the picture desired. It is made in stained walnut, the brass springs

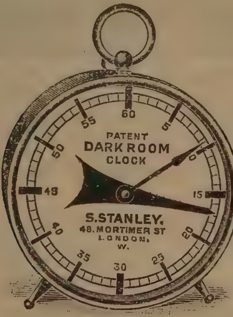


and catches being polished so that the rough edges are removed. The frame is neatly made.

STANLEY'S PATENT DARK-ROOM CLOCK.

Manufactured by S. Stanley, 48, Mortimer Stret, Cavendish Square, W.

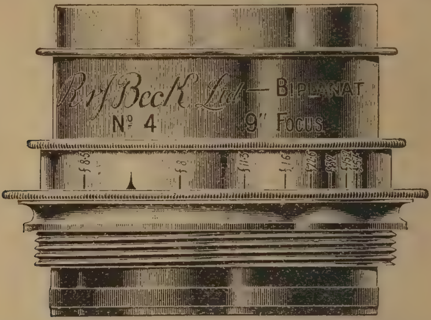
This appliance does conveniently what a watch does extremely inconveniently. Its general appearance is that of one of the ordinary nickel-plated clocks, thousands of which are in general use; the difference is that the hour hand is replaced by a broad wedge-shaped hand which marks seconds—that is to say, making a revolution of the dial in one minute. The minute hand is normal and makes the revolution in an hour in the usual way, and it can be put back to zero as in an ordinary clock. The dial is four inches in diameter, and can be plainly seen even at some distance away, and in the darkest of dark-rooms. In addition to dark-room work, there are many photographic operations in which such an instrument will be found a great convenience.



THE BECK BIPLANAT.

Sold by R. and J. Beck, Limited, 68, Cornhill, E.C.

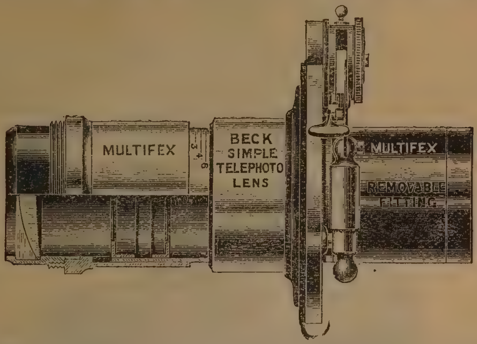
This series, with an aperture of *f*5.8, has been designed to meet the demand for a lens of high intensity at a moderate price. The smaller sizes are intended for hand camera work, and their rapidity is sufficient to meet all the demands of focal plane work. The larger sizes are offered as a substitute for the Petzval portrait lens. The prices are very moderate in comparison with those to which the photographer has become accustomed since the appearance of the modern anastigmat. The lenses are well designed, of good external finish, and fitted with iris diaphragms. As they are of the rectilinear type, the tests for astigmatism do not apply, and in judging of their work due regard must be given to the exceptionally large aperture which has been given them. In adjusting the compromise which must necessarily be made between great rapidity and fine definition when the rectilinear construction is adopted, Messrs. Beck have aimed at satisfying both demands. The residuum of spherical aberration which is present in the lens at full aperture, may meet the wishes of the portraitist, and the great rapidity of the instrument permits of a liberal use of the diaphragm for critical work. Such lenses are of the universal type, and are well suited to the wants of the amateur, or professional, who requires one lens to do the work of many.



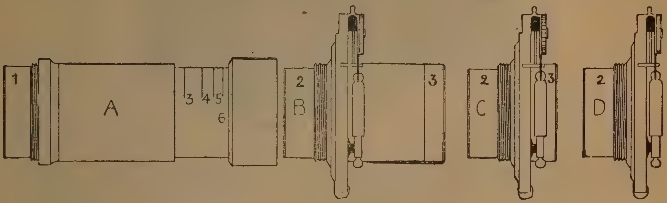
THE MULTIFEX SIMPLE TELEPHOTO LENS.

Manufactured by R. and J. Beck, 68, Cornhill, E.C.

The Multifex lens consists of a specially constructed double combination lens, of two positive lenses mounted similarly to an ordinary R.R. lens, the mount being fitted with a shutter working between the combinations and arranged for time, bulb, and instantaneous exposures. An iris diaphragm is also provided. Behind this double combination, and separated from it by a focussing mount, is a lens of negative focus constituting a telephoto attachment. The Multifex lens in its entirety consists, therefore, of three combinations, the front and middle lenses being positive and the back negative. Removing the back lens and its focussing tube and screwing the combination of the front and middle lenses into the camera flange, there results an ordinary double combination lens of 6 inches focus (that is, for the $\frac{1}{4}$-plate size) working at an aperture of *f*/7. By removing the front lens a single combination lens remains of 11 inches focus and working at an aperture of *f*/12. Using the Multifex complete as shown in the illustration, there results a lens having an adjustable focus of from 18 to 36 inches, according to the position of the back lens.



For practical purposes the Multifex lens may be regarded, then, as a rapid rectilinear lens with a telephoto attachment. There is nothing new to be said about the use of the lens as a rapid rectilinear, or the use of one of its combinations, except that provision is made for removing the lens when used as a single lens further from the diaphragm by means of an extension tube, thereby improving its quality at a large aperture. With regard to the use of the lens complete, the focussing tube is marked with four lines numbered respectively 3, 4, 5, 6, which refer to the amount of magnification over the original lens obtainable by adjusting the tube to these lines; thus 3 indicates that the magnification is three times, that is, that the lens is adjusted to a focus of three times its original focus of 6 inches, or 18 inches, and so on. A table is given showing the equivalent focus and the circle of illumination or field of the lens under its varying conditions of use, and also the camera extension required and the relative value of full aperture. Thus in the particular lens we are referring to, the $\frac{1}{4}$-plate, the figures are: R R, lens alone, focus 6 inches, extension 6 inches, circle 8 inches, stop *f*/7; with telephoto attachment, three magnifications, focus 18 inches, extension 6 inches, circle 5$\frac{3}{4}$ inches, stop *f*/22; four magnifications, focus 24 inches, extension 9 inches, circle 8$\frac{3}{4}$ inches, stop *f*/30, etc. Under any circum-

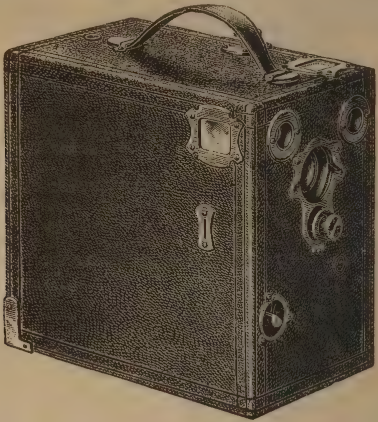


stances, a ¼-plate is covered, and with the higher magnifications the lens may be employed for larger plates. The Multifex is supplied in two sizes, ¼-plate and ½-plate, the focus of the latter being based on the original focus of 7½ inches.

THE FRENA MAX CAMERA.

Manufactured and sold by R. and J. Beck, Limited, 68, Cornhill, E.C.

The Frena Max takes either forty cut films or twelve glass plates in sheaths. Using the former, the well-known alternate notch system is availed of; so, too, with regard to the plate sheaths. Messrs. Beck remind photographers that in the Frena system three manipulations repeated for each exposure are all that is actually required of the operator: (1) Wind the shutter; (2) expose by setting off the shutter; (3) change the film by turning a handle.

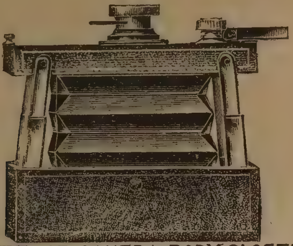


We may enumerate the principal features of the Frena Max: It has two "Cornex" brilliant view finders; a rectilinear lens; four adjustable diaphragms; an automatic counter to register the number of plates used; two tripod sockets; one movement of the handle changes the film and makes ready for the next exposure. The film is changed with the camera in the same position as it is when the photograph is taken. The instrument measures 8½in. by 9½in. by 4¼in., and it is well and strongly made.

THE MINIMUS CAMERA.

Sold by Arthur Rayment, 125, Earlham Grove, London, E.

This little apparatus, whose exterior dimensions are 3⅝in. long, 2 3-16in. wide, 1⅛in. deep, is specially constructed to meet the demand of a great number of serious amateur and professional photographers, who require a camera of the very smallest possible dimensions, which at the same time is capable of yielding negatives of such crisp definition that they will bear such enlargement as to produce photographs of presentable and frame-able size. It is fitted with an achromatic rectilinear lens, working at F.8, or if preferred with a Zeiss, Goerz, Steinheil, or other high-grade objective. The shutter gives varying speeds of instantaniety or prolonged exposure. By pressing two springs the camera opens instantly, ready for use. The single dark slides are of oxidised metal, thoroughly light tight. These slides are scarcely ⅛ of an inch in thickness, and six together weigh less than six ounces. They carry plates of a popular size, 2 5-16in. by 1¾in., which are stocked by dealers throughout the United Kingdom, as also by all Continental dealers under the equivalent metric dimensions—viz., 4½ by 6 centimetres.

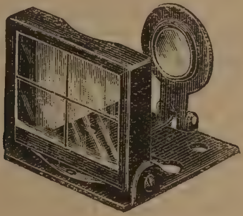

SIZE OF CAMERA BODY CLOSED
3¾ x 2⅛ X 1¼ INCHES

OPEN.

A MAGNIFYING DIRECT VIEW FINDER.

Sold by Arthur Rayment, 125, Earlham Grove, London, E.

This finder depicts the image or view the right way up—*i.e.*, not inverted—with all detail greatly amplified. It possesses one concave and one convex lens. To view objects through the concave lens of an ordinary direct finder a distance of 8 inches or thereabouts must intervene between

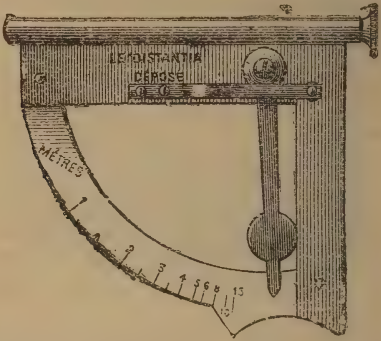


the eye of normal focus and the lens. Under these circumstances the detail of landscape, architectural, or other subject becomes too minute to be distinguishable. By the addition of a convex lens of suitable focus—correctly distanced from the concave, as shown in the diagram—all the fine detail of foliage in a landscape or ornamental carving on a building is distinctly brought to the operator's view. To employ the finder with this additional lens to the maximum advantage it is desirable that the eye should be brought close to it, when it will be found that the visual angle of the two lenses used thus in combination is equal to the visual angle of the concave used alone.

THE "DISTANTIA," OR DISTANCE MEASURE.

Sold by Arthur Rayment, 125, Earlham Grove, London, E.

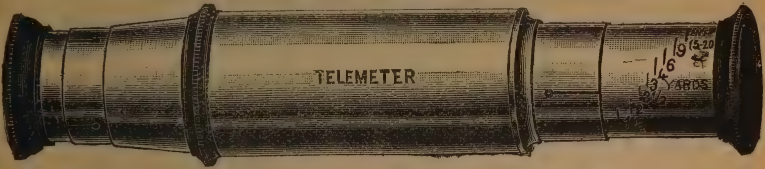
When using a hand camera it is most difficult to judge by the eye alone the distance between the instrument and the object to be photographed. With the Distantia one can determine with rapidity and exactness the distance between apparatus and subject. The "Distantia" is convenient for the pocket, weighing only 2 ounces, whilst its size may be judged by the fact that the radius of the arc is 2½in. It is made of thin of metal oxidised, and it consists of a sight tube, mounted over a graduated arc, with a plummet pivoted at its centre. The accuracy of measurements is ensured by the arc being adjustable so as to accord with the height of the operator. When desiring to make an observation the instrument should be held in the right hand, the thumb occupying the curved detent immediately below the pointer as shown in the diagram. The sight-tube must be brought up to the eye and pointed downwards to the base of the subject; the plummet released from its controlling spring by pressure of the index finger on a head projecting from the posterior face of the angular frame. When the base of the subject is plainly seen in the centre of the tube the pressure of the finger must be withdrawn, without jerk or shake, from the spring, which will lock the plummet on the arc opposite to the finger indicating the distance in yards between the operator and his subject.



A PHOTO-TELEMETER.

Sold by Arthur Rayment, 125, Earlham Grove, London, E.

The idea of this little instrument was suggested years ago by Mr. Traill Taylor as a most useful addition to hand cameras or to field cameras when employed for instantaneous photography, The diagram below shows the body of the Photo-Telemeter to be composed of tubes telescoping into each other. At the end of the graduated tube a lens is affixed. At the reverse end of the instrument is a focussing magnifier, and between the two, quite close to the magnifier, is a finely ground glass screen, thus forming a small camera, the objective of which may be of the identical focus or the same focus approximately as the camera lens of the operator. The Photo-Telemeter may be used either in the hand or preferably attached to the camera. In the latter case the tube must be arranged parallel with the body of the camera and attached so that the lenses and focussing screens of the two instruments are respectively on the same planes one above the other or side by side. When thus connected the rack and pinion actuating the camera will at the same time extend the draw tubes of the Photo-Telemeter, and the operator having arranged the sensitive plate in the camera ready for exposure, will focus on the Photo-Telemeter and view the centre of the subject to be photographed during exposure on the twin camera principle.



THE FREEWHEEL COMBINED ROLL, FILM, AND PLATE CAMERAS.

Manufactured by the Busch Camera Co., 35, Charles Street, Hatton Garden, E.C.

These cameras are made in various models which follow more or less the lines of other film cameras and have adjustments and accessories according to price. Their essential feature is in the mechanism at the back of the camera, which allows each picture to be focussed by means of a focussing screen before exposure, and permits a dark slide, or rather a special plate-holder, to be inserted and used without disturbing the film already in adjustment; thus alternate exposures may be made on a plate and the film, if desirable, focussing each picture immediately before exposure. The mechanism is by no means complicated. To deal with the arrangement of the film first: Any make of rollable film may be used. The method of fitting the spool of film to the camera differs slightly from that usually employed inasmuch as a spindle is used as with the ordinary receiving spool. The receiving spool is a special one fitted to the camera, and has attached a band of celluloid rather more than double the width of the plate, one half being ground to form a focussing screen and the other half being transparent. When the spool of unused film has been inserted in its place, the protecting paper is unwound a turn or so, and is attached to the band of celluloid by means of a strip of gummed paper, thus forming a continuous band.

The camera back having been closed, the band may now be wound on the receiving spool until the indicating number appears at the window, and the exposure made exactly as in the usual form of film cameras. The usual form of camera, however, does not permit of the band being wound backwards; that is from the receiving spool to the original spool. This is for two reasons, firstly, the receiving winder has a ratchet which prevents it turning backwards, and, secondly, there is no outside attachment to the original spool to enable it to be turned. In the free-wheel cameras, the receiving winder has a ratchet which normally prevents back-winding, but it is fitted with a device—a catch which reverses the action and permits the film to be free to be unwound from the receiving spool, but holds it in the winding direction. The original spool is fitted on a similar winding spindle, with outside key and reversible ratchet. The key in this case is at the bottom of the camera, so that, while normally the band is wound precisely in the usual way from the original spool to the receiving spool, by bringing the catches on both winders into action, the action may be reversed at any time, and the film wound back from the receiving to the original spool. When the whole of the film and its black paper protector has been rewound on the original spool, the celluloid focussing screen comes into position for use. Thus the film may be wound backwards and forwards at will, and if necessary the focussing screen brought into position for focussing between each exposure.

For using plates, a particularly thin metal plate holder is employed, having a draw-out shutter, and a ground-glass focussing screen of similar dimensions is provided. At the top of the camera is found a spring slide. On withdrawing it a slot is disclosed for the entry of the plate-holder, having a trap to prevent the entry of light into the camera. The position of the plate-holder in the camera, when ready for exposing, is in front of the film, which may be left in its position all the time. For focussing, when a plate is to be used, the glass-focussing screen must be inserted and the film wound on the original spool, continuing the winding until the transparent celluloid is behind the screen, and through it the image can be seen on the ground-glass.

An incidental advantage in the free-wheel system is that the film can always be kept at tension, and therefore flat. This overcomes the difficulty of sagging of the film, which sometimes arises from the suction caused by drawing out the bellows quickly, and from other natural causes. The back having a focussing opening also allows the use of the Ensign-Vidil film.

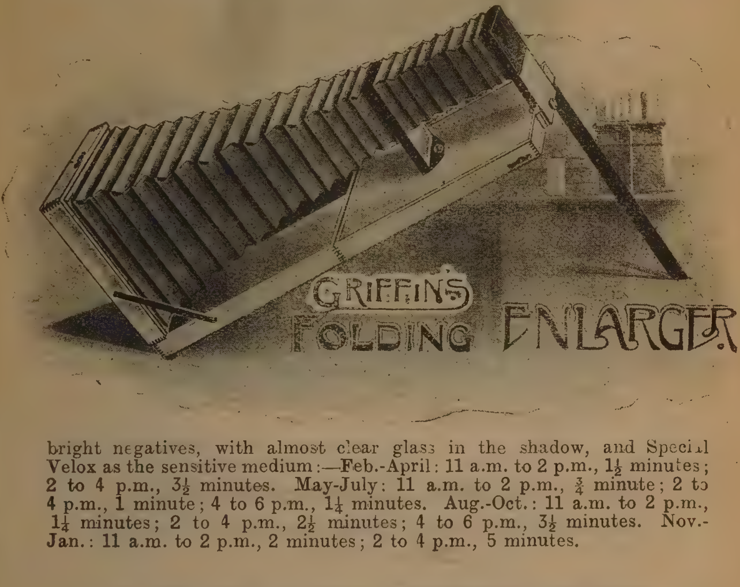
The model B camera has a rising and falling front, and is fitted with a Busch detective aplanat, working at *f*6. The shutter may be the Unicum or the Wollensak automatic everset shutter.

THE "VELOX" FOLDING ENLARGER.

Sold by John J. Griffin and Sons, Ltd., 20-26, Sardinia Street, Lincoln's Inn Fields, W.C.

This compact and easily mastered piece of apparatus is of the collapsible kind, and packs into a small space. A reference to the illustration will show the instrument in actual use. Messrs. Griffin's own description may be quoted to more fully emphasise the ready manner in which it may be availed of:—

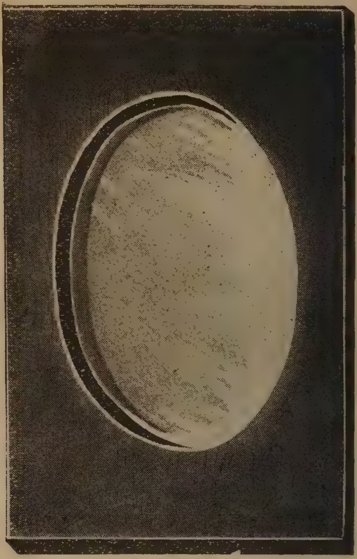
To open the enlarger, release the three spring catches which hold the parts together, and extend the folding base-board. Then pull out bellows and attach the lens and negative supports to the base by means of the thumb-screws. See that the holders are vertical and well screwed down. The negative must be placed in the grooves at the small end, film side inwards. If films are to be enlarged, place the same between the two pieces of glass supplied and insert as you would a glass negative. To charge the enlarger with the sensitive paper, remove the wooden back and insert a piece of Velox or bromide paper, sensitive or film side towards the glass. Then replace back and turn the hold-fast spring until held by the supports. Exposure: Carry the enlarger out into daylight—an even, diffused light is essential—if sunlight cannot be avoided, cover the negative with a piece of ground glass or fine tissue paper—and place on the ground with the negative pointing to the sky. The length of exposure varies according to the time of year, of day, and condition of negative. The following may assist as a guide, the figures being for good, bright negatives, with almost clear glass in the shadow, and Special Velox as the sensitive medium:—Feb.-April: 11 a.m. to 2 p.m., 1½ minutes; 2 to 4 p.m., 3½ minutes. May-July: 11 a.m. to 2 p.m., ¾ minute; 2 to 4 p.m., 1 minute; 4 to 6 p.m., 1¼ minutes. Aug.-Oct.: 11 a.m. to 2 p.m., 1¼ minutes; 2 to 4 p.m., 2½ minutes; 4 to 6 p.m., 3½ minutes. Nov.-Jan.: 11 a.m. to 2 p.m., 2 minutes; 2 to 4 p.m., 5 minutes.



THE "KAHLBAUM" REFLECTING MIRROR.

Sold by John J. Griffin and Sons, Ltd., 20-26, Sardinia Street, Lincoln's Inn Fields, London, W.C.

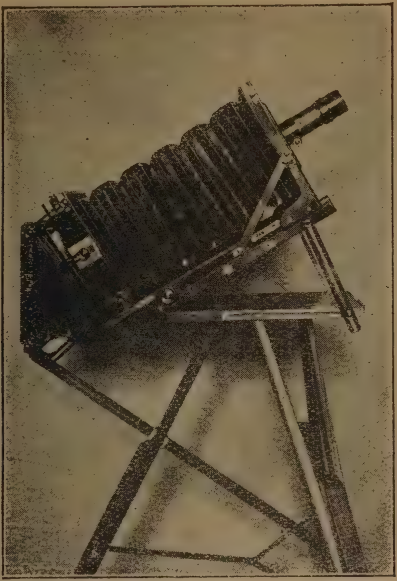
As a substitute for prisms and silvered glass mirrors in the production of negatives for process work, Messrs. Griffin have introduced an optically flat polished mirror, which it is claimed retains its reflecting efficiency, unaffected by atmospheric action. It is made of a patented metal composition, and to be kept in order all that is required is an occasional rub with a soft leather or a piece of fine cotton wool. The principal advantages claimed for the mirror are (1) diminution of exposure as compared with prisms, (2) crispness of image, freedom foom distortion, and accuracy of surface. A 4½ by 3½ size, we note, costs £5 16s., which includes a special frame, by which the mirror may be used in existing mirror boxes.



A SPECIAL CAMERA FOR TELEPHOTO WORK.

Manufactured by The Service Photographic Society, 292, High Holborn, W.C.

This camera, which was originally designed for the use of the Archæological Department of the Ceylon Government, consists essentially of a long extension camera of the ordinary parallel bellows type, having all the usual adjustments, to which is fitted a specially arranged swing-back, allowing the camera to be tilted upwards or downwards to the extent of about 45 deg. with the horizontal, while maintaining the back in a vertical position. The illustration shows the adjustment of the swing-back when the camera is pointed upwards. It will be seen that a supplementary bellows is employed to allow of the separation of the back from the camera body. In using the camera pointed downwards, a similar amount of swing in the opposite direction is obtained by reversing the positions of the top and bottom slotted struts. To assist in securing stability and freedom from vibration when the camera is in use, a wooden bar is provided, attachable to the back of the camera by a huge joint passing through a swinging socket on the tripod leg, where it is

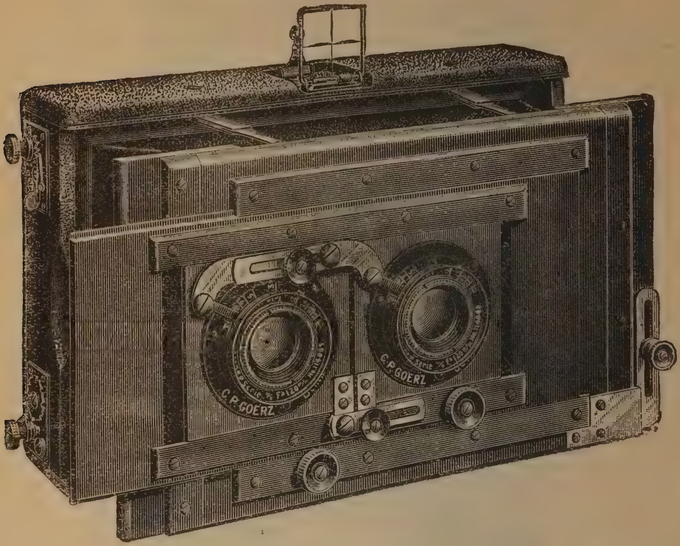


locked by a screw when the adjustments have been made. The tilting stand has both a slotted supporting strut and a slide in the base board, thus allowing the strut to be placed in practically any position to suit the need or convenience of the occasion.

THE "GOERZ ANSCHUTZ" STEREOSCOPIC CAMERA.

Sold by C. P. Goerz, 4 and 5, Holborn Circus, London, E.C.

This camera is built on the collapsible form, so familiar to the users of the "Goerz Anschutz Folding Camera." It opens out by means of what may be described as a double lazy-tongs movement. The front carrying the lenses rises, falls, and slides, so that the photographer has every necessary movement on the lens plane. Focussing is controlled by the side to side movement of a lever, which actuates both objectives. We note with great satisfaction that easy command is obtained over that most important matter, the separation of the lenses. These are fixed in sliding panels, which, when close together, give a separation of 2½in., between which, and the maximum separation of 3½in., adjustment is readily facilitated. The shutter is a focal plane, and as the stereoscopic septum is readily removable, the fact that the lens panel may be moved to one side allows of the whole of the plate being used for a single photograph. A detachable hooded focussing glass is provided, and double dark slides are used. The finder is of the cross wire variety. The camera before us is made to the well-known 6¾ by 3¼ size, in dark wood with bright metal fittings. The lenses are Double Anastigmats, working at 6.8.



THE NEW "ADON" TELEPHOTO ATTACHMENT.

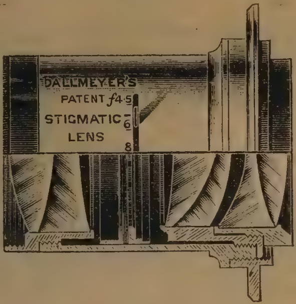
Manufactured by J. H. Dallmeyer, Limited, 25, Newman Street, W.

Dallmeyer's Simple Telephoto Lens, the "Adon," was hardly launched when the last "Almanac" went to press, and consequently escaped notice. It is, however, probably known to most of our readers, and the remainder will find a full description in our advertising pages. A new special form for use with Kodaks and other film cameras is now ready, in which there is a fixed degree of magnification without loss of rapidity, while focussing may be effected by means of a scale. A feature of this attachment is that the plate is covered to the corners with a moderate camera extension, 8 in., the definition at full aperature being excellent. The new "Adon" is not available as an independent lens in the same way as the standard pattern, but for the particular purpose for which it is designed it performs in an equally satisfactory manner.

THE NEW SERIES, F.4.5 STIGMATIC LENS.

Manufactured by J. H. Dallmeyer, Limited, 25, Newman Street, W.

The Stigmatic Portrait Lens, Series I., working at *f*4, although possessing all the optical properties of a lens suitable for extremely rapid work, has the disadvantage of being very heavy. To overcome this disadvantage, the new series has been introduced. The lenses of the new series are at present made in three sizes—namely, 5in., 6½in., and 8in. focus. Although, of course, it has been impossible to reduce the amount of glass employed to any great extent, the new lenses, which work at *f*4.5, against *f*4 of the older series, have been somewhat modified to this end, and the mounts, which are of magnalium, are as light as it is possible to make them, preserving the necessary strength and rigidity. The new lenses are therefore well adapted for use on a hand camera, and where extreme rapidity is required their flatness of field and freedom from astigmatism and spherical aberration at the open aperture will prove very useful.



RICE'S STEREOSCOPIC TRANSPOSER.

Manufactured by W. Watson and Sons, 313, High Holborn, W.C.

This apparatus is for the purpose of printing stereoscopic transparencies without cutting the original negative. It is adapted for all the sizes of negatives used for stereoscopic work, including the half-plate. Any part of the negative can be selected and centred on the positive plate. Non-perpendicular pictures, caused by a side-tilt during exposure, can be corrected. The two halves of the stereo can be perfectly joined without blurring, and the distance between corresponding points can be regulated. The adjustment is mechanical, and the plate can be accurately registered in total darkness if required. The negative is not moved during the operation, and a clamping device prevents any risk of movement of the sensitive plate when once placed in position for exposure. The frame is perfectly light-tight. When exposing either half, the other is automatically covered. After each exposure the plate can be lifted from the frame without disturbing the negative. The illustration shows the transposer with pressure-board removed, and a negative and positive plate in position ready for exposure. It show also the method of printing positives with a true base from non-perpendicular negatives. It will be seen that the apparatus consists of an outer frame in which the negative is adjusted, provision being made for taking any of the ordinary size negatives. This is provided with screws at the ends and sides to enable the inner frame to be adjusted and clamped to any position. The inner frame itself is provided with adjustable stops to permit of some variation in the length of the transparency plate. The transparency plate is placed in contact with the side and end of the frame for the first exposure, and with the side and the previously adjusted stop at the other end for the second exposure. A sliding shutter is fixed to the front of the frame, and when this is central all light is excluded. The two exposures are made by moving the shutter alternately to the right and left. Of course, a pressure-board is provided for the back, which is not shown in the illustration.

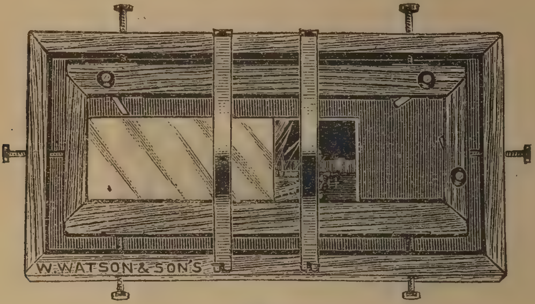


Fig. 1.

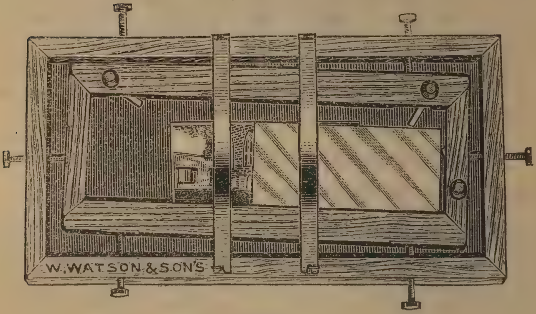


Fig. 2.

NEW PATTERN TRIPODS.

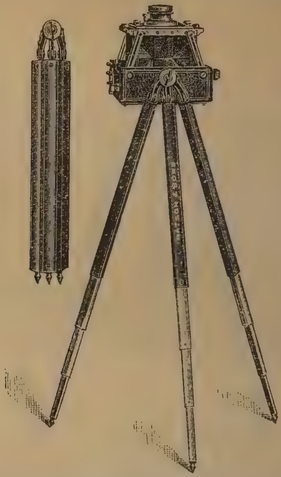
Manufactured by W. Watson and Sons, 313, High Holborn, W.C.

The ordinary pattern of aluminium tripod is constructed with an attachment for the camera which prevents the camera revolving on the head to point the lens in a different direction. To alter the direction the stand has to be moved bodily. The improved pattern is fitted with a revolving head, which practically answers the purpose of a turntable.

The "quickset" tripod is a combination of wood and aluminium, the wood replacing the metal in the lower joints, just where a metal tripod is most likely to get bent. The substitution does not make any appreciable addition to the weight, which is 1½lb., nor in bulk. The head is

permanently attached to the legs, and the tripod is set up ready for the camera very rapidly.

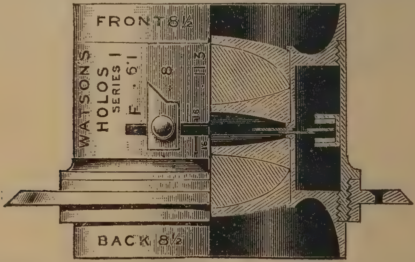
The "Flat Folding Tripod" is of entirely new design. One of its features is the form of the head, to which the legs are permanently attached. It is so constructed that an extreme amount of tilt is possible, and the camera may be adjusted so that the lens is pointing vertically, either upwards or downwards. The stand when extended measures 48in. When folded and in its leather-carrying case the outside measurements are 15in. by 2½in. by 1in., so it is extremely portable.



THE HOLOSTIGMAT CONVERTIBLE LENS, SERIES II., F. 8.

Manufactured by W. Watson and Sons, 313, High Holborn, W.C.

These lenses have been designed as less expensive substitutes for those of the No. 1 series for all purposes not requiring a higher rapidity than f/8. The correction of chromatic and spherical aberration, of astigmatism and curvature of field, render this lens suitable for copying and

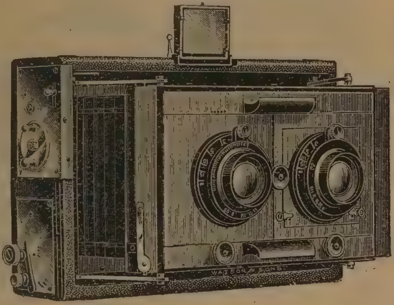


for process work. When used for general photographic purposes it offers the same advantages as Series I in being convertible, and thus giving a choice of two or three different foci. Hemi-symmetrical combinations may be chosen, composed of a front lens and a back lens two sizes smaller, with a combined focus equal to that of the intermediate symmetrical doublet and a rapidity of about *f*/9·5; the advantages being a more favourable gradation of the three foci. Thus a front lens of 14in. focus combined with a back lens of 10in. focus forms a doublet of 6¾in., giving an excellent choice of foci for a half-plate camera.

THE VRIL FOCAL PLANE STEREOSCOPIC CAMERA.

Manufactured by W. Watson and Sons, 313, High Holborn, W.C.

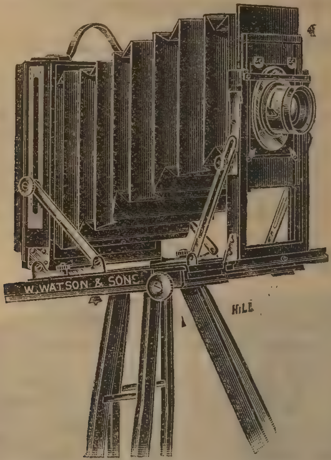
The Vril camera is now supplied for stereoscopic work. The lenses are fitted to a sliding front, so that one of the lenses may be brought to the centre of the camera, and, the internal partition being removed, the entire plate may be used for one panoramic picture. The lenses are fitted into special focussing tubes, and the necessary adjustments are made by means of a lever which works both lenses simultaneously in and out of their mounts. The back portion of the camera consists of the vril focal plane shutter, giving instantaneous exposure one-fifth to one-thousandth of a second and adjustable for time exposures, the adjustment for speed and the alteration of the width of the slit being effected from outside. In addition to the horizontal motion there is a rising front. The camera is covered with black leather, the front and focussing frame being ebonised mahogany. A speed tablet is attached to each camera giving shutter speeds, with various combinations of slit and tension.



WATSON'S "IMPROVED" ACME CAMERA. 1903 MODEL.

Manufactured by W. Watson and Sons, 313, High Holborn, W.C.

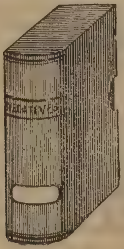
The general plan of the Acme camera is too well known to need description. The improved model introduced during the year has three new adjustments. To meet the requirements of photographers using the now popular convertible anastigmat lenses and telephoto attachments, a triple extension base is now fitted, which allows an increase of bellows extension amounting to about 33 per cent. A new double action form of rising front is provided, which enables the bellows to be raised so as not to interfere with the rays from the lens, however high the latter may be raised above the normal position. An engraved circle is fitted to the inside of the base reading by a vernier engraved on the turntable. This will be found useful for panoramic views, which can be taken with the certainty of their not overlapping. Also in outdoor photography, in cases where children are apt to pose in front of the camera, rendering it impossible to take the desired view, the picture can be focussed and the exact position of the camera noted by the vernier, so that at a favourable opportunity, the dark slide being inserted, the attention of the children can be diverted by pointing the camera in an opposite direction. It can then be returned to the original position and the view secured.

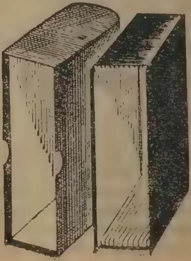


BOOK FORM NEGATIVE BOXES.

Manufactured by Arundel & Marshall, Penn St. Works, Hoxton, London.

The construction of these negative boxes is essentially the same as that of the ordinary grooved negative boxes of this firm, and internally are fitted with



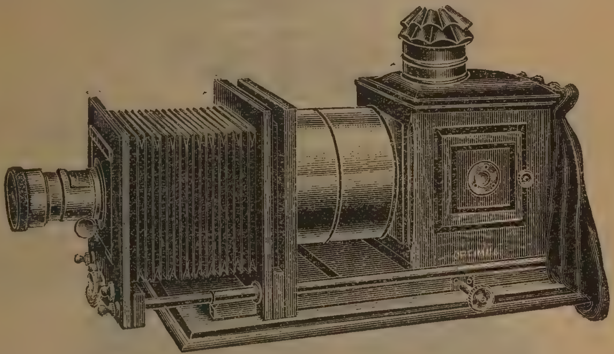


metal grooving, with a covering of paper, for protecting the film of the negatives from abrasion. They may be had either to contain twelve negatives, one in a groove, or in a more compact form, containing six grooves, for two negatives, placed back to back, in each groove. The innovation is in the outward form, which is made the shape of a bound volume, allowing the boxes to be placed on ends on a shelf like a row of books, and presenting an equally neat appearance. Each volume, or box, is neatly stamped "Negatives" where the title of a book would come, and from the bottom a slip of paper or thin card may be inserted, an opening in the back being provided, showing a space in which the numbers of the negatives or other distinguishing marks may be inscribed.

THE OPTIMUS "PERFECT" ENLARGER.

Manufactured and sold by Perken, Son, & Co., Ltd., 99, Hatton Garden, London, E.C.

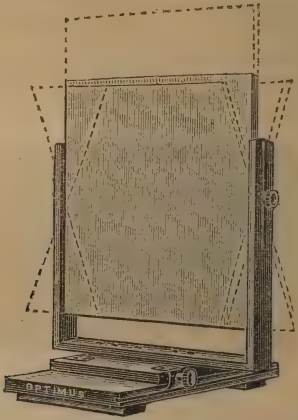
This apparatus has been constructed so as to be capable of reducing as well as enlarging, and, in order to add to ease in manipulation, the light chamber, which has a wide range of adjustment, is provided with a rack and pinion, thus enabling a careful distancing of the illuminant from the condenser to be made. The bellows-front, which is of the best leather, has an extension almost equal to the length of the baseboard; consequently reducing to the smallest possible limits comes within it capabilities. The stage where the negative is inserted is similar to those of all the Optimus models, being entirely open at the top, so enabling portions of large negatives to be amplified. A fine twin screw for accurate focussing is fitted to the lens board of each apparatus. An ample light-chamber is provided, the outside being of polished mahogany and the inside being lined with metal, the interior space allowing of the employment of any form of illuminant.



OPTIMUS SWINGING EASEL.

Manufactured and sold by Perken, Son, & Co., Ltd., 99, Hatton Garden, London, E.C.

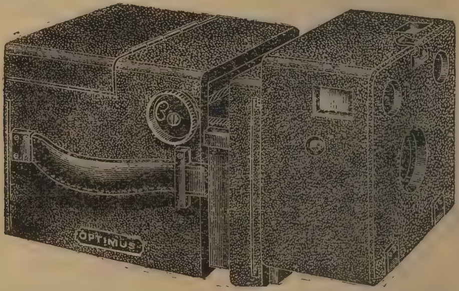
To the enlarger of snap-shot negatives the Optimus Swinging Easel must be regarded as almost a necessity. The adjustment with which it is provided enables vertical lines rendered imperfectly in the negative to be corrected in the enlargement; a very secure clamp fixing the swinging surface when the desired angle has been reached. The easel has an adjustment for height, so that the centre of the board may be brought to exactly the same level as the centre of the projection lens, and a rack and pinion adjustment fitted to the base enables the operator to focus sharply whilst closely viewing the enlarged picture on the prepared surface of the easel. This piece of apparatus is made of well-seasoned polished pine.



OPTIMUS CHANGING BOX.

Perken, Son, & Co., Ltd., 99, Hatton Garden, London, E.C.

This changing box is made of well-seasoned wood covered with morocco leather and has no leather bag to become worn and leaky, the changing of the plate or films being effected by drawing out, by means of its handle, the telescopic body to its fullest extent and pushing it home again. The withdrawing of the shutter when plate is in position for exposure in the camera is so arranged that no stray light can pass. The magazine chamber, which will hold 24 cut films or 12 plates in metal sheaths, is easily charged in the dark room.



PERKEN'S "REX" CAMERA.

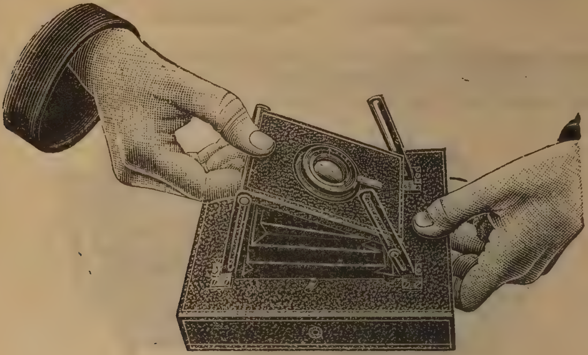
Made and sold by Perken, Son, & Co., Ltd., 99, Hatton Garden, London, E.C.

This camera is of very simple construction, but possesses many advantages that will appeal to the hand camera worker. In the first place it is of small dimensions and can be carried in the hand ready for immediate exposure. Twelve plates (or films) of quarter-plate size are changed by means of a leather bag, the removal of the exposed plate being effected by the finger and thumb. Rising fronts are fitted for use either horizontally or vertically. The lens is a Rapid Rectilinear having a between-lens shutter giving exposures up to 1-100th second and also time exposures. The setting of the shutter does not expose the plate. The finders are of the Brilliant type. Objects can be focussed from 3 ft. to infinity and the adjustment is by rack and pinion. This camera is capable of being used with any make of lens of suitable focus and of a type adaptable to the between-lens shutter.

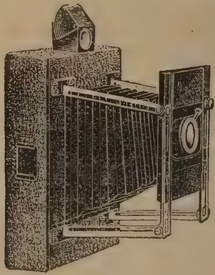
THE PENNA FOCAL PLANE CAMERAS.

Manufactured by Wallis Bros., Kettering.

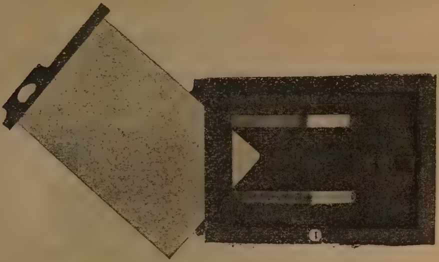
As the practical efficiency of the focal plane shutter becomes more and more recognised, and the demand for cameras fitted with this exposing device increases, the inventive faculties of manufacturers are called into play to simplify the mechanism and provide means of adapting the shutter for all-round use. The latest simple form of the Penna Focal Plane Shutter which forms part of the Penna F.P. Camera is designed to simplify speed calculations as much as possible. To avoid the complication arising from a variable tension and a variable slit in the blind, a blind is used having two apertures of fixed size; a wide one giving, according to tension, exposures from one-fifth to 1-70th of a second, and a narrow one giving exposures from 1-150th to 1-1000th of a second. Normally the shutter works with the large slit, which is the full width of the plate. For setting, the blind simply requires to be wound up until it will wind no further, and a touch of the trigger releases it. When set the fact is notified in print on the blind, and whether the wide or narrow slit is in play. Time exposures may also be given by setting the "Time" lever, when the first pressure of the



rigger or pneumatic ball opens the shutter and the second closes it. When he narrow slit is required a special button is pressed at the same time as the trigger release, and the portion of the blind containing the narrow slit becomes unwound. In this state the blind may be set and released as often as required, the narrow slit only passing to and fro, and to revert to the wide slit merely requires the special button to be pressed while winding.



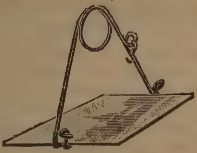
The speed of the blind is varied by turning the speed knob, the indicator showing the speed of the shutter in fractions of a second both with the wide and narrow slits. The construction of the camera is extremely simple. It consists practically of the shutter in its wooden case, on one side of which is mounted an arrangement for carrying the focussing screen and the dark slide, and on the other are the bellows and the front carrying the lens. When closed these go inside the shutter case occupying the space between the rollers which carry the shutter blind. When extended the bellows are held in place by four automatically locking stretchers. The focussing is effected by turning a lever on the lens mount. The plate holders have several points of novelty. They are of the solid form with aluminium shutters, which can be entirely withdrawn. There is a patent flexible light trap which prevents the access of light even if the shutter be inserted corner-ways. The method of holding the plates is simple and ingenious. There are no buttons to turn, and the plate snaps into position when pressed downwards and releases itself on pressing a spring catch. The Penna Focal Plane Shutter can be had apart from the camera, and can be adapted to any existing camera.

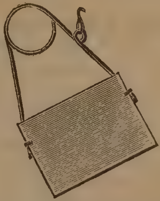


THE WALLIS PLATE LIFTER.

Manufactured by Wallis Brothers, Kettering.

The foot of the lifter is broad so that the plate is held quite firmly, and can be lifted out of the developer for examination with perfect safety and ease. One lifter will fit several sizes of plates, but for the larger sizes two lifters will be found more convenient. The lifter can also be used for holding the plates when drying. For this purpose the plates are put into the lifter vertically instead of horizontally, and hung up by the small hook at one side. This allows the water to drop off at one corner.

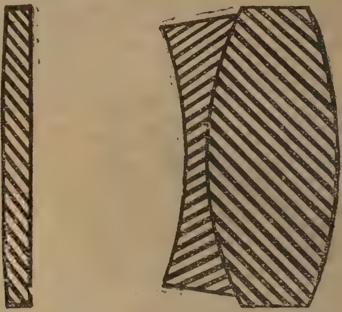




THE ALDIS ANASTIGMATS. New Series III. *f* 7·7.

Manufactured and sold by Aldis Bros., Old Grange Road, Sparkhill, Birmingham.

The diagrams clearly show the modifications which Messrs. Aldis Brothers have introduced into their now well-known patent construction of three simple lenses, of which two are cemented to form a doublet anastigmat. This series works at *f* 7·7, but for the comparatively slight reduction in rapidity an extraordinary reduction in weight and size and also in cost is effected, notably in the No. 7 Series III. half-plate lens. The new series, it will be observed, has an unusually thick biconvex for the first element, which, cemented to an almost equally powerful negative biconcave, results in an exceptional concentration of the incident light as it emerges from the front corrector element, and consequently the actual size of the iris diaphragm opening needed at *f* 7·7 is considerably smaller than the effective aperture of the lens. In fact, so much is this the case that the No. 7 Series III, 7½ lens is actually mounted in cells to screw into the same shutter or body tube as the quarter-plate and 5 x 4 plate Series II. lenses, and forms, with them, an interchangeable set. Some idea of the compactness of this little instrument will be obtained when we say that the mount measures from end to end a few hundredths of an inch only in excess of one and a quarter inches, and the outside diameter of the body tube is less than the length.



IMPROVEMENTS IN ACETYLENE APPARATUS.

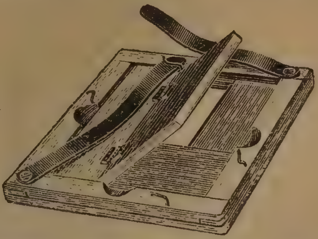
R. J. Moss & Sons, 98, Snow Hill, Birmingham.

The combined purifier and tray, which we described in last year's Almanac, has been improved by adding a small purifier to the acetylene generator itself, the addition only involving the increase of 3 in. in height, and of less than 1 lb. in weight. The additional parts are adapted by a large screw cap, which is easily renewable. A novel appliance consists of a funnel for filling the carbide chamber from, the removing the unused carbide from the chamber back to the storage tin. The funnel really consists of a connecting tube, attachable both to the mouth of the storage tin and to the filling orifice of the carbide chamber, and permits the passage of the carbide without allowing the escape of the objectionable fumes which arise from carbide when exposed to the air. The funnel fits over the carbide tin, and takes up practically no room. A new introduction is a series of carbide holders, especially useful for travelling. The bins are made to hold 2 lb., 3 lb., or 7 lb. of carbide, and are fitted with the "acetylite" screw cap and washer.

THE WALLIS PATENT POSTCARD PRINTING FRAMES.

Manufactured by Wallis Brothers, Kettering.

There are two patterns of this printing frame. The simpler form takes a quarter-plate negative, and is made square, and is so designed that any portion of the negative may be printed on any portion of the postcard, and by the arrangement of the springs and catches at the back the hinged, backboard may be inserted so that, whatever the position of the postcard, the part printing may be examined.



The Adaptable Post Card Printing Frame is similar in design but, by means of a series of adaptors or carriers, any size negative up to half-plate may be used. The adaptors supplied ordinarily are for ½-plate, 5 by 4, ¼-plate, and 3½ by 2½.

MISCELLANEOUS INFORMATION.

NOTES ON INCOME TAX.

By an Accountant.

This tax was first imposed in its present form in 1842, but has subsequently been amended by various Acts of Parliament. It is interesting to note that an Act relating to income tax is generally entitled "An Act for granting to His Majesty Duties on Profits arising from Property, Professions, Trades, and Offices." For the purpose of assessment it has been found convenient to apportion the sources of profits and to collect them separately. These assessments are therefore divided up into "schedules," called A, B, C, D, and E respectively.

Schedule A relates to property, and if the familiar landlord's tax; schedule B relates to the profits of husbandry; schedule C refers to incomes from Government or Colonial dividends, etc.; this tax is deducted from the dividend before payment, and the net money only handed over. Schedule D, which is by far the most important, and to which our remarks will chiefly apply, relates to profits from professions and trades; also interest on money and other annual profits and gains not charged under any other schedule; finally, schedule E refers to persons who enjoy a fixed income derived from holding office under the State, public corporations, etc. Under all these schedules the rate of tax is the current income tax. We have frequently remarked that in many cases a great deal of misunderstanding seems to exist with regard to the persons by whom the declarant can claim to be assessed. These important gentlemen are divided into two classes, termed District and Special Commissioners. We have besides the Surveyors, who are revenue officers with fixed salaries; their duties are numerous; they attend the meetings of the District Commissioners, compare the returns of the tax-papers with the estimates of the assessor, and ascertain their correctness by reference to the valuation for the poor rate and other information they may obtain. All requests of persons to be assessed under schedule D pass through their hands, and in ordinary cases of assessment under that schedule, when the clerk to the Commissioners has completed the certificates of assessment, they are examined by them with the returns before they are submitted to the additional Commissioners for consideration. But to revert to the Commissioners themselves, the District Commissioners are justices of the peace of the district, and certain other gentlemen of good position, whose impartiality and integrity are beyond doubt; the Special Commissioners are professional servants of the Crown, and travel on circuit. Taxpayers may choose to be assessed by the District Commissioners in the ordinary course, or under a number or letter, provided such intention be signified in the declaration of income, and be addressed to the "Clerk of the Commissioners"; or by the Special Commissioners. Here again the intention must be similarly expressed, but the declaration should be addressed to the "Surveyor of Taxes," and endorsed "For Special Assessment." It is important to remember that when an exemption is claimed the taxpayer cannot appeal to the Special Commissioners. As regards the year of charge, this runs from April 5th to the next April 5th, which it includes; the accounts should therefore be made up to these dates, unless the accounts are in the habit of being made up to a different date, then to such date in such year ending such 5th of April. Appeals usually take place about the month of October, but the date fixed for notice of appeal is usually stated on the assessment note. The appeal must be made out in the proper form and be lodged in time.

Now we have reached the point at which our account is to be prepared, it is not out of place to point out that incomes under £160 are totally exempt from the tax, while those over £160 and under £400 are allowed an abatement of £160; those over £400, but not exceeding £500, abate £150; those over £500, but not exceeding £600, abate £120; and, lastly, those over £600, but not exceeding £700, abate £70. Other exemptions and allowances will be treated later on. As these notes are penned for the use of photographers, we shall confine our attention to schedule D, and the remarks that follow will apply to that schedule, unless otherwise specially stated. The form for the return of income is issued by the assessors about May or June, and plenty of time is given to fill in the particulars. Space is provided for claiming total exemption or the statutory abatements, and for other allowances. Again, if there are partners in the business, and they desire to be separately assessed, in order to claim separate abatements, they can do so if they state their desire in the space provided. As has been previously pointed out, the mode under which the assessment is to be made must also be stated, if the ordinary way—that is per the Local Commissioners—is not agreeable.

The return must show the total income, and the expression "total income" means "total income from every source." Thus if dividends have been received during the year, even though the tax has been deducted from them before payment is received, they must be included in the return, only care should be taken to state "tax deducted" opposite items the tax on which has been already paid. The omission to include these items is no doubt made under the error that they will be subject to taxing again, but this is not so; it should be remembered that the officials cannot sanction the exemptions or abatements demanded unless the full total amount of income is shown. Here note that the omission to make a return of income to the Income Tax Commissioners as required by them is punishable by a penalty of £20 and treble duty; while, if anyone untruly declares his income or fraudulently conceals any part of it, the penalty for so doing is £20 and treble the duty chargeable. It is, of course, only necessary to make a return under schedule D of those portions of income which are chargeable under some other schedule, when a claim for abatement or exemption is to be established. The return should be made from the place of business or from where the profession is carried on, on an average of the three years preceding, ending as before stated. If the business has commenced within three years, then on a proportionate average; or if commenced within the year of assessment, the profits must then be estimated, and the grounds of such estimate stated to the Commissioners. Before actually passing to the consideration of special items in the account submitted to the authorities, we would wish to draw the attention of our readers to an important concession granted by the Finance Act of 1897—this deals with the case of where the joint income of the wife and husband does not exceed £500. By Section 5 (1) "Where the total income of a husband and wife charged to income tax, by way either of assessment or deduction, does not exceed £500, and upon a claim for exemption, relief, or abatement, under the Acts relating to income tax, the Commissioners for general purposes of these Acts are satisfied that such total income includes profits of the wife from any business carried on, or exercised by means of her own personal labour, and that the rest of the total income or any part thereof arises or accrues from profits of a business carried on or exercised by means of the husband's own personal labour, and unconnected with the business of the wife, they shall deal with such claims as if it were a claim in respect of the said profits of the wife, and a separate claim on the part of the husband in respect of the rest of the total income, but they shall deal with any income of the husband arising or accruing from the business of his wife or from any source connected therewith, as if it were part of the income of the wife." In appeals against assessment it is very advisable for the appellant to give all the information in his power, as if the Surveyors are properly treated they will be found considerate and fair, but if their suspicions are once aroused they are sure to give trouble in the future. In order to ascertain exactly what amount of profit or loss has been made, the photographer should prepare a profit and loss account in the usual way. If this is done every year it will be unnecessary in the summary to give the details of the two preceding years, as the authorities in case of dispute will probably have the figures themselves; it is, however, advisable for the trader to himself keep a copy of the accounts from which he makes his return, and for the sake of convenience these should be written up in a book kept for the purpose; it is then always handy for reference when required. The account will, of course, show the stock at the commencement and at the end, which must not be estimated, but definite amounts. On the debit side we should expect to find, *inter alia*, the following items:—

1.—Purchases less returns.
2.—Discounts on sales.
3.—Salaries and commissions (agents').
4.—Carriages and incidental expenses.
5.—Rent.
6.—Rates, gas and water, and fire insurance.
7.—Life insurance.
8.—Banker's commission.
9.—Interest on loans.
10.—Repairs of utensils.
11.—Repairs of premises.
12.—Bad debts.
13.—Wear and tear of machinery.
14.—Depreciation of lease.
15.—Depreciation of a patent, buildings, or office furniture.
16.—Income tax paid.
17.—Interest on capital.
18.—Interest on partners' salaries.
19.—Annuities and donations.
20.—Partners' drawings.
21.—Partners' salaries.
22.—Capital withdrawn.
23.—Interest on mortgage.

We cannot do better than consider these items separately. Probably an accountant finds more confusion existing in the mind of the person responsible for drawing up the account for income tax purposes, as to what is and what is not allowed to be charged, than he does in any other matter of a similar character. We have therefore purposely included a number of possible sources of expenditure which perhaps only rarely occur in a photographer's accounts, but should they have to be included, they will then be known how to be dealt with. Of course, it is at once understood that all these sources of expenditure decrease the profits of the business, and therefore reduce the sum on which the income tax is to be paid. On the one hand we have the appellant trying his best to be allowed to include all he can on his debit side, and on the other hand we have the income tax authorities jealously preserving their rights from being taken from them. Let us consider the list we have just given in detail.

1.—Purchases, less returns. This calls for little, if any, comment. The purchases must not be merely estimated, but must be the real amount, as got from the invoice book and the day book. The returns will, of course, be ascertained from the returns book, and the amount will be deducted from the purchases and the net figure extended.

2.—Discounts on sales. This item speaks for itself, and is allowed to be charged.

3.—Salaries. No sum must appear under this heading on account of any remuneration made to a principal for performing the duties of manager, traveller, or any other officer. Such items should appear under the heading given lower down in the list, No. 20, partners' drawings, No. 21, partners' salaries. The salaries of the printers, operator, retouchers, clerks, etc., are, of course, allowed to be charged against the gross profit.

4.—Carriage and incidental expenses. These charges are only allowed if they are incurred in connection with the business, and no charges of a private nature unconnected with the business should be included.

5.—Rent. The premises occupied will be found to have a value placed on them by the surveyors. If the rent paid differs from this assessment figure under schedule A you are allowed to eliminate out of your profit and loss account altogether the rent you paid, and to charge instead the assessment figure under schedule A. For example, you pay £50 a year for rent, but your assessment under schedule A is £60. You will therefore charge the £60 against your profit, instead of the £50; it is important to remember this. If the business premises belong to the trader, the amount of the property tax assessment must be inserted. Frequently photographers will occupy part of the premises for the purposes of a dwelling-house; then a sum not exceeding two-thirds of the rent or the net annual value of the same should be entered to the debit of the profit and loss account, according to the value used for trade purposes. If the business premises are the property of the photographer, but he has to pay a ground rent on them, this cannot be charged in the accounts, as the assessment is already included under schedule A. However, the current rate of income tax can be deducted from the sum paid to the ground landlord in respect of ground rent. So, too, and for a similar reason, if there be a mortgage on the property, the interest thereon cannot be included in the accounts, for it has been taken into consideration in arriving at the net annual value of the property. The current rate of income tax can, though, be taken from the amount of the mortgage interest when this is paid.

6.—Rates, gas and water, and fire insurance. Here note that no sum paid in respect of income tax on the annual value of trade premises under schedule A, or trade profits under schedule D, should be included in this item.

7.—Life insurance. This is a very important charge, and there are interesting concessions in connection therewith. Claims for repayment of tax on insurance premiums require a statement of income and the particulars of the premiums paid annually. Premiums paid on the life of one's wife may also be claimed on. The claim must be sent to Somerset House, with the insurance receipts for which repayment is asked, attached. Claims for three years can, if necessary, be made on one form, and, of course, it need hardly be pointed out that a deferred annuity is allowed in the same way as an ordinary life assurance. Accident policies, pure and simple, are not subject to repayment of tax on premiums paid, unless the policy covers death by accident. Claims on these policies (life and accident including death) must be restricted to one-sixth of the total income. Thus if a person receive £600 per annum from all sources, he may claim to the extent of £100 annual premiums. The special form prescribed is No. 39, and it should be noted that it is a claim made for an allowance, and not a charge against the profits.

8.—Banker's commission. This is a charge against the profit which is sanctioned by the income tax authorities, though interest on loans and mortgages in existence for one year or more are not allowed. The bank interest is calculated according to the period of the overdraft, and is paid without deducting the tax.

9.—Interest on loans. This is not allowed to be charged against the profits of the business, as on the payment of the interest the tax is deducted. If, however, the loan is for less than one year the tax would not be deducted, when the interest would be allowed to be debited.

10.—Repairs of utensils. This is arranged for by Section 100 of the Income Tax Act, 1842, which provides that in computing the balance of profits or gains, no sum shall be set against or deducted from profits or gains on account of any sum expended for the supply, or repairs, or alterations of any implements, utensils, or articles employed for the purposes of such trade, manufacture, adventure, or concern, beyond the sum usually expended for such purposes, according to an average of three years preceding the year in which such assessment shall be made. When an extraordinary renewal takes place, say of a piece of machinery, the method usually employed is to find out how many years it will last, and divide this number into the cost of the article, and write off this figure to the profit and loss account every year. On the article ceasing to be of any material value, it will then be found to have been written off the books.

11.—Repairs to premises. Here again the rule is that no sum is allowed for such purposes to be written against the profits, beyond the sum usually expended for such purposes according to an average of three years preceding the year in which such assessment was made.

12.—Bad debts. This includes those debts which have to be written off as really worthless, or which can be proved to the satisfaction of the Commissioners are bad. A list must be prepared, showing the names and addresses, together with the amounts of the debts and dates when contracted. In the case of doubtful debts they will only be allowed when they can be specifically appropriated, and then an estimated sum may be charged against the gross profit—it need hardly be said that bad debts are allowed to be debited.

13.—Wear and tear of machinery. This is treated of in Section 12 of the Customs and Inland Revenue Act, 1878; and Section 100 of the Income Tax Act, 1842 (previously referred to in No. 10), is also read with this section; it provides that "the Commissioners for general and special purposes shall, in assessing the profits or gains of any trade, adventure, or concern in the nature of trade chargeable under schedule D, or the profits of any concern chargeable by reference to the rules of that schedule, allow such deduction as they may think just and reasonable as representing the diminished value by reason of wear and tear during the year of any machinery or plant used for the purposes of the concern, and belonging to the person or company by whom the concern is carried on." Note, however, that where a sum has been charged or allowed against the profits for renewals and alterations of machinery, plant, tools, etc., the Commissioners will not allow any sum by reason of wear and tear. This rule is followed by the Commissioners, acting on the principle laid down in the appeal case of the Caledonian Railway Company, which was as follows:—"Where deductions had been allowed for the renewals, repairs, or alterations of machinery, plant, utensils, or tools, and the same afterwards prove capable of earning the same amount of income as when new, no further deduction could be claimed." And it was also stated that "deduction for deterioration cannot be claimed twice over—first by deducting the actual expenses of repairs and renewals, and then by deducting an additional estimate sum for the same thing." This item has been thus fully (though not exhaustively) treated, as it is a matter over which many appellants go wrong. It is the custom to charge this deduction for wear and tear against the profit, and then wait for the Commissioners to object thereto.

14.—Depreciation of lease. Any sum expended in the improvement of premises, or written off for depreciation of land, buildings, or leases, is not allowed to be charged against the profits for income tax purposes.

15.—Depreciation of a patent, buildings, or office furniture. Similarly these items, though usually charged against the profits, are not allowed to be so treated by the Commissioners.

16.—Income tax paid. This is a tax on the profit, and consequently is not allowed to be deducted.

17.—Interest on capital. This is part of the income, and must therefore not be deducted.

18.—Interest on partners' salaries. Exactly the same remark applies here as to the interest on the capital—it is not allowed to be charged against the profits.

19.—Annuities and donations. Subscriptions, donations, gratuities, and such similar payments are not allowed to be charged against the profits.

20.—Partners' drawings. Since such sums of money are taken for the private uses of the partner, they obviously cannot be charged against the profit for the purposes of income tax.

21.—Partners' salaries. Moneys paid to partners as salaries for management or direction are not allowed to be deducted in striking profits or gains. They form part of the income, and therefore are in the same category as interest on capital.

22.—Capital withdrawn from the business is not a charge against the profits, and is not allowed to be deducted.

23.—Interest on mortgage. When the interest is paid the tax is deducted, consequently interest must not be charged against the profit.

In the above list we have included the majority of items usually found on the debit side of profit and loss accounts, and also items which only rarely occur. It is, however, we well know, a matter of some difficulty to decide whether an amount charged against the profits will or will not be allowed by the Commissioners of Income Tax. These gentlemen are only too pleased to see you add to the credit side of your accounts any moneys you like, but when you commence to charge sundry items against your profits, claiming them as legitimate trade expenses, they have an awkward way of coming in and sadly disillusionising you on the subject. All losses unconnected with or not arising out of the trade cannot be charged against the profits, nor can such items as sums employed or intended to be employed as capital in trade; preliminary expenses incurred in setting up the business; payments made to trade associations; exhaustion of capital; disbursements not wholly and exclusively laid out for trade; disbursements or expenses of maintenance of the parties, their families, or establishments; or any sum expended in any other domestic or private purposes distinct from those connected with trade.

With this list beside him, we think that the appellant should find his path considerably smoothed, and perhaps there may be even cause for gratefulness on his part that we have thus fully dealt with it.

We are frequently asked the question as to how casual profits are to be treated. The whole question turns on the exact nature of the profits—do they form part of the taxpayer's regular business profits or not? Obviously if they are really casual profits they cannot do so. Thus, profits on dealings in properties, stocks, shares, chattels, etc., are not chargeable with tax, provided the transactions do not form part of the subject of a taxpayer's profession or trade, or a taxpayer cannot be said to be generally effecting such transactions for purposes of profit. And surely this must be a moot point? "Generally effecting such transactions for purposes of profit." Most people try to add to their incomes in some way or other, and thus apparently do it for purposes of profit, but whether they are right in not including these casual additions in their returns to the Commissioners, we should not care to definitely state here. We do know, though, that "conscience" money is often paid, as anyone may see who reads the "agony" columns of *The Times*, so doubtless, on maturer consideration, there are some who incline to the strict path of virtue and patriotism. Thus, for instance, if the profession of a gentleman was that of a journalist, we should say that in addition to any regular salary he might obtain from his employers, he should also account for all moneys received by him in the exercise of his calling as a journalist, as these would rightly be considered a part of the profits of his profession. Genuine casual profits, though, undoubtedly need not have the tax paid on them; similarly, losses thereon are not deductable as against profits or gains of other kinds which are chargeable with tax. A very interesting question arises on this point: How far can the income tax authorities claim to go back if they suspect one of giving false returns of income? Apparently, since the debt is one due to the Crown, they can take the account back as far as they like, as a debt of this character is out of the operation of the Statute of Limitations. Whether or not such power would be exercised is a question, we think, of the circumstances of each case. We recollect a friend of ours who was in receipt of a good income, which he was so fortunate as to be able to supplement in various ways, thougt these additions were nearly all by the exercise of the same knowledge and skill which he used in his every-day profession. He, however, only made a return of his regular business profits, and was quite under the impression that he was acting properly in doing so; the authorities, though, on becoming aware of the details of the case, came down on the gentleman, and considerably frightened him by going back for some number of years over these outside profits. In this case he was let off very lightly, and warned to "sin no more." We believe that the custom is not to go back more than six years, but we cannot for the moment trace the precedent. These things are better settled as amicably as possible, considering the large powers of the Commissioners, and if the offender insists on being contumacious he will certainly only be the loser thereby. In this connection it should be noted that no taxpayer can be compelled to produce his books of account to the Commissioners, but if they request them for the purpose of verifying the account submitted, and they are not produced, the assessment in question may be confirmed by them, and so no relief will be granted to the appellant. Solicitors and barristers are allowed to plead before the General Commissioners on any appeal, either *viva voce* or in writing, but an accountant has no *locus standi*. They are, however, sometimes permitted to explain the accounts, and, speaking generally, if the accounts are properly drawn up and duly certified by a qualified accountant, there will not usually be any trouble with the Commissioners. If on any appeal the appellant is prevented from appearing on the appointed day owing to sickness or other reasonable cause, the Commissioners may extend the time for the purpose, or allow the same to be made by any agent, clerk, or other servant on behalf of such appellant. It is, of course, understood that since the profits on a business are subject to taxation, the losses are also allowable. Thus in the following summary there are two years on which a profit is made, and on the third year a loss is the result; the treatment is self-explanatory:—

	1900.	1901.	1902.
Returns	£6,000	£7,000	£7,500
Net expenses	£6,500	£6,000	£6,200
Balance	Loss £500	Profit £1,000	Profit £1,300

Summary:—

Profit 1901 ... ... £1,000
Profit 1902 ... ... £1,300

£2,300
Less loss 1900 ... ... £500

£1,800

The average profits for the three years is therefore £1,800 divided by three, equals £600.

In the above example it will be noted that the expenses are marked "net." By this is meant that it is the figure which is allowed to be charged by the Commissioners against the profits for the purposes of taxation. What is and what is not allowed to be charged we have already fully shown, and this net figure is the result of the application of those rules.

It is quite possible that there are many photographers who have more than one class of business, and it is conceivable that one business may show a return of profits, whilst another one may unfortunately not be so successful. How are such matters allowed to be treated for income tax purposes?

Section 101 of the Income Tax Act, 1842, provides "that nothing (in the Act) shall be construed to restrain any person carrying on, either solely or in partnership, two or more distinct trades, manufactures, adventures, or concerns in the nature of trade, the profits whereof are made chargeable under the rules of schedule D, from deducting or setting against the profits acquired in one or more of the said concerns the excess of the loss sustained in any other of the said concerns over and above the profits thereof, in such manner as may be done under this Act where a loss shall be deducted from the profits of the same concern, or to restrain any of such persons from making separate statements thereof." Note, however, that if such particular trade, adventure, manufacture, or concern on which the loss has been made shall cease to exist during the year preceding the year of assessment, the loss on any one of them cannot be taken into account in the three years' average in fixing the assessment of the trader for the following year. The above remarks should make the treatment of this class of case perfectly clear; there remains the question of a business having various branches or depôts. In case either of the two make losses and are consequently closed, the losses on the same being part and parcel of the business are charged in the accounts thereof, and the assessment is based on the average of the profits and losses of the three preceding years in respect of the current year. We have yet to consider whether the loss under one schedule of the Act can be set off against the profits on another schedule. The Customs and Inland Revenue Act, 1890, Section 23, provides that "where any person shall sustain a loss in any trade, manufacture, adventure, or concern, or profession, employment, or vocation carried on by him either solely or in partnership, or in the occupation of lands for the purpose of husbandry only, it shall be lawful for him, upon giving notice in writing to the Surveyor of Taxes for the district, within six months after the year of assessment, to apply to the Commissioners for the General Purposes of the Acts relating to Income Tax for an adjustment of his liability by reference to the loss and to the aggregate amount of his income for that year, estimated according to the several rules and directions of the said Acts. The said Commissioners shall, on proof to their satisfaction of the amount of the loss, and of the payment of income tax upon the aggregate amount of income, give a certificate authorising repayment of so much of the sum paid for income tax as would represent the tax upon income equal to the amount of loss, and such certificate may extend to give exemption or relief by way of abatement in accordance with the provisions of the said Acts. Upon receipt of the certificate, the Commissioners of Inland Revenue shall cause repayment to be made in conformity therewith." "If any person shall be guilty of any fraud or contrivance in making any application under this Section, or in obtaining any such adjustment or certificate as aforesaid, he shall forfeit the sum of fifty pounds, to be recoverable as a penalty imposed by virtue of the Taxes Management Act, 1880."

As in the previous instance, it should be noted that no portion of the loss, as mentioned above, can be taken into account in arriving at the average profit assessable in a subsequent year.

Finally, we may consider the position of a person who shall cease to carry on his business, or shall be removed by death or become bankrupt. Here again it is better to give the full text of the Act, as it is most clearly set out, quite intelligible to anyone, and cannot be satisfactorily condensed:—

Section 134 of the Income Tax Act, 1842, provides "that in case any person charged to the said duties under Schedule D, whether the computation thereon shall have been made on the profits of one year or on an average . . . shall cease to exercise the profession or to carry on the trade, employment, or vocation in respect whereof such assessment was made, or shall die, or become bankrupt or insolvent, before the end of the year for making such assessment, or shall from any other specific cause be deprived of or lose the profits or gains on which the computation of duty charged in such assessment was made, it shall be lawful for such person, or his executors or administrators, to make application to the Commissioners for General Purposes of the district, within three calendar months after the end of such year, and on due proof thereof to their satisfaction, the said Commissioners shall cause the assessment to be amended, as the case may require, and give such relief to the party charged, or his executors or administrators, as shall be just, and in cases requiring the same, the said Commissioners shall direct repayment. . . to be made of such sum as shall have been overpaid on the assessment amended or vacated: provided always that where any person shall have succeeded to the trade or business of the party charged, no such abatement shall be made, unless it shall be proved to the satisfaction of the said Commissioners that the profits and gains of such trade or business have fallen short from some specific cause to be alleged to them and proved, since such charge or succession took place, or by reason thereof, but such person so succeeding to the same shall be liable to the payment of the full duties thereon without any new assessment."

It should be noted that whereas the responsible officers of limited companies are compelled to furnish the salaries, etc., paid to their employees for the purposes of income tax assessments, the proprietors of a private business need only furnish a list of the names.

We have mentioned before that there are four other schedules under which income tax is collected, but as it is with schedule D that photographers are chiefly concerned, our remarks have been confined to it only.

The other schedules are equally as important, and require to be carefully filled in where they have to be used; but we have already, we fear, somewhat wearied the reader by discussing, even so incompletely as the short space at our disposal only admits of, such a wearisome subject as the incidences of the tax on trade profits. We can only assure those who may have read our article that we have but taken the most salient features and reviewed them. So many cases have special points of their own that it is not possible to go into full detail, but we have had to try and isolate those points which we think are likely to come within the possible scope of the average photographer's business, and by our explanations remove some of the difficulties of making returns which will afford him the maximum benefits.

We trust we have not been altogether unsuccessful. In conclusion, we would wish to point out to those who may have some special point of difficulty in connection with income tax returns, and which we have not included in the above remarks, that there are several excellent treatises published on the subject, the names of two or three of which we append below, a consultation of which will probably throw much light on the subject. For general purposes Mr. James Rhodes, Chartered Accountant, of Birmingham, has written and published a most excellent little shilling pamphlet, which we can strongly recommend, and which we have found most useful in compiling this article. Just those points which are generally wanted, and which are only too often missed out, are most lucidly explained, and the book will be found very useful as a short practical guide. Where this pamphlet is not complete enough, we would recommend the reader to study either of the following: "The Acts relating to the Income Tax Act," by the late Stephen Dowell, M.A., fifth edition, revised, altered. and enlarged by J. E. Piper, LL.B., published by Messrs. Butterworth and Co.; and "A Guide to Income Tax Practice," by Murray and Carter, published by Messrs. Gee and Co., 34, Moorgate Street, E.C.

THE NEW PATENTS ACT.

Chapter 34.

An Act to amend the Law with reference to Applications for Patents and Compulsory Licences, and other matters connected therewith.

[18th December, 1902.]

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1.—(1) Where an application for a patent has been made and a complete specification has been deposited by the applicant, the examiner shall forthwith, in addition to the inquiries which he is directed to make by the Patents, Designs, and Trade Marks Act, 1883 (in this Act referred to as the principal Act), make a further investigation for the purpose of ascertaining whether the invention claimed has been wholly or in part claimed or described in any specification (other than a provisional specification not followed by a complete specification) published before the date of the application, and deposited pursuant to any application for a patent made in the United Kingdom within fifty years next before the date of the application.

(2) If on investigation it appears that the invention has been wholly or in part claimed or described in any such specification, the applicant shall be informed thereof, and the applicant may, within such time as may be prescribed, amend his specification, and the amended specification shall be investigated in like manner as the original specification.

(3) The examiner shall report to the comptroller the result of his investigations in such manner as the Board of Trade may direct.

(4) The provisions of subsection five of section nine of the principal Act, as amended by any subsequent enactment, shall apply to reports under this section.

(5) If the comptroller is satisfied that no objection exists to the specification on the ground that the invention claimed thereby has been wholly or in part claimed or described in a previous specification as before mentioned, he shall, in the absence of any other lawful ground of objection, accept the specification.

(6) If the comptroller is not so satisfied, he shall, after hearing the applicant, and unless the objection be removed by amending the specification to the satisfaction of the comptroller, determine whether a reference to any, and, if so, what, prior specifications ought to be made in the specification by way of notice to the public.

(7) An appeal shall lie from the decision of the comptroller under this section to the law officer.

(8) Section eight of the principal Act and section three of the Patents, Designs, and Trade Marks (Amendment) Act, 1885 (which regulate the time for depositing a complete specification), shall have effect as if references therein to the period of nine months were references to the period of six months.

(9) The investigations and reports required by this section shall not be held in any way to guarantee the validity of any patent, and no liability shall be incurred by the Board of Trade or any officer thereof by reason of, or in connection with, any such investigation or report, or any proceeding consequent thereon.

(10) The Board of Trade, with the sanction of the Treasury, may prescribe an additional fee not exceeding one pound in respect of the investigation mentioned in this section, which shall be payable on the sealing of the patent.

(11) This section shall come into operation at such date as the Board of Trade may by order direct, and shall apply only to applications made after that date, and the order shall be laid before both Houses of Parliament.

2. An invention covered by any patent granted on an application to which section one of this Act applies shall not be deemed to have been anticipated by reason only of its publication in a specification deposited pursuant to an application made in the United Kingdom not less than fifty years before the date of the application to a patent therefor, or of its publication in a provisional specification of any date not followed by a complete specification.

3. Section twenty-two of the principal Act (relating to the grant of compulsory licences by the Board of Trade) is hereby repealed, and the following provisions shall be substituted therefor:—

(1) Any person interested may present a petition to the Board of Trade alleging that the reasonable requirements of the public with respect to a patented invention have not been satisfied, and praying for the grant

of a compulsory licence, or, in the alternative, for the revocation of the patent;

(2) The Board of Trade shall consider the petition, and if the parties do not come to an arrangement between themselves, the Board of Trade, if satisfied that a primâ facie case has been made out, shall refer the petition to the Judicial Committee of the Privy Council, and, if the Board are not so satisfied, they may dismiss the petition.

(3) Where any such petition is referred by the Board of Trade to the Judicial Committee, and it is proved to the satisfaction of the Judicial Committee that the reasonable requirements of the public with reference to the patented invention have not been satisfied, the patentee may be ordered by an Order in Council to grant licences on such terms as the said Committee may think just, or, if the Judicial Committee are of opinion that the reasonable requirements of the public will not be satisfied by the grant of licences, the patent may be revoked by Order in Council;

Provided that no order of revocation shall be made before the expiration of three years from the date of the patent, or if the patentee gives satisfactory reasons for his default;

(4) On the hearing of any petition under this section the patentee and any person claiming an interest in the patent as exclusive licensee or otherwise, shall be made parties to the proceeding, and the law officer or such other counsel as he may appoint shall be entitled to appear and be heard;

(5) If it is proved to the satisfaction of the Judicial Committee that the patent is worked or that the patented article is manufactured exclusively or mainly outside the United Kingdom, then, unless the patentee can show that the reasonable requirements of the public have been satisfied, the petitioner shall be entitled either to an order for a compulsory licence, or, subject to the above proviso, to an order for the revocation of the patent;

(6) For the purposes of this section the reasonable requirements of the public shall not be deemed to have been satisfied if, by reason of the default of the patentee to work his patent or to manufacture the patented article in the United Kingdom to an adequate extent, or to grant licences on reasonable terms, (*a*) any existing industry or the establishment of any new industry is unfairly prejudiced, or (*b*) the demand for the patented article is not reasonably met;

(7) An Order in Council directing the grant of any licence under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed granting a licence, and made between the parties to the proceeding;

(8) His Majesty in Council may make rules of procedure and practice for regulating proceedings before the Judicial Committee under this section, and, subject thereto, such proceedings shall be regulated according to the existing procedure and practice in patent matters. Any Order in Council or any order made by the Judicial Committee under this Act may be enforced by the High Court as if it were an order of the High Court;

(9) The costs of and incidental to all proceedings under this section shall be in the discretion of the Judicial Committee, but in awarding costs on any application for the grant of a licence the Judicial Committee may have regard to any previous request for, of offer of, a licence made either before or after the application to the Committee;

(10) For the purposes of this section three members of the Judicial Committee shall constitute a quorum;

(11) This section shall apply to patents granted before as well as after the commencement of this Act.

4. In subsection four of section eighty-two of the principal Act (which

relates to the performance of the duties of the comptroller by other officers under the direction of the Board of Trade) the words "in his absence" shall be repealed.

5. This Act may be cited as the Patents Act, 1902, and may be cited and shall be construed as one with the Patents, Designs, and Trade Marks Acts, 1883 to 1901.

FISCAL FACTS.

The following brief summary of the import duties on photographic goods into various European countries was compiled by Dr. Burner for "Die Photographische Industrie":—

1. Belgium.—Optical instruments free; stands 10 per cent. ad valorem; glassware 10 per cent. ad valorem; photographic paper 4 francs per kilo.
2. Bulgaria.—All photographic articles must pay a duty of 14 per cent. ad valorem, and a further internal tax of 2 per cent. ad valorem.
3. Denmark.—Plates 16 2-3 oere per pound; optical instruments 33 1-3 oere per pound; photographic paper 5 5-24 per pound or 10 per cent. ad valorem.
4. Germany.—Apparatus according to the nature of the materials; albumen and other papers 10 marks per kilo; dry-plates 24 marks per 100 kilos.
5. Finland.—Dry-plates 21.20 Finn. marks per 100 kilos; apparatus and accessories 105.90 Finn. marks per 100 kilos; papers 176.50 Finn. marks per 100 kilos.
6. France.—Plates 30 francs per 100 kilos; albumenised, arrowroot, and other salted papers (not sensitised) 100 francs per 100 kilos; sensitive papers and films 200 francs per 10 kilos; non-sensitised papers 30 francs per 100 kilos; optical instruments free.
7. Greece. Plates 33.06 paper drachmas per 100 oka; papers 79.35 paper drachmas per 100 oka; optical instruments and apparatus free.
8. Great Britain.—*All photographic articles are duty free.*
9. Italy.—Papers 40 lire per 100 kilos; plates 18 lire per 100 kilos; optical apparatus 30 lire per 100 kilos.
10. Holland.—All photographic articles pay 5 per cent. ad valorem.
11. Norway.—Plates 30 kronen per kilo; lenses 200 kronen per 100 kilos; papers 8 kronen per 100 kilos; apparatus are assessed according to materials.
12. Austria-Hungary.—Albumen and gelatine papers 5 gold gulden per 100 kilos; plates 12 gold gulden per 100 kilos; apparatus, classed as "optical instruments," 200 gold gulden per 100 kilos.
13. Portugal.—Apparatus 50 reis per kilo; plates 20 per cent. ad valorem; sensitive papers 25 reis per kilo.
14. Roumania.—Prepared papers 28 lei per 100 kilos; plates 50 lei per 100 kilos; apparatus duty free.
15. Russia.—Plates 45 roubles per pood; apparatus 10.20 roubles per pood; papers 13.20 roubles per pood.
16. Sweden.—Papers 20 krone per 100 kilos; plates 30 krone per 100 kilos on gross weight; apparatus 200 krone per 100 kilos gross.
17. Switzerland.—Plates 30 francs per 100 kilos; apparatus 16 francs per 100 kilos; papers 30 francs per 100 kilos.
18. Servia.—Papers 10 dinars per 100 kilos; plates 12 dinars per 100 kilos; apparatus 50 dinars per 100 kilos.
19. Spain.—Plates 100 pesetas per 100 kilos; papers, 48.75 pesetas per 100 kilos; apparatus 200 pesetas per 100 kilos.
20. Turkey.—All photographic articles pay 8 per cent. ad valorem.

THE COPYRIGHT (WORKS OF ART) ACT (1862).

An Act for amending the Law relating to Copyright in Works of the Fine Arts, and for repressing the Commission of Fraud in the Production and Sale of such Works.

WHEREAS by law, as now established, the authors of paintings, drawings, and photographs, have no copyright in such their works, and it is expedient that the law should in that respect be amended: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Copyright in Works Hereafter Made or Sold to Vest in the Author for his Life, and for Seven Years after his Death.

1. The author, being a *British* subject or resident within the dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the *British* dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect.

Copyright not to prevent the Representation of the Same Subjects in Other Works.

2. Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright, or to represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

Assignments, Licenses, &c., to be in Writing.

3. All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every license to use or copy by any means or process the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent appointed for that purpose in writing.

Register of Proprietors of Copyrights in Paintings, Drawings, and Photographs to be kept at Stationers' Hall, as in 5 & 6 Vict., cap 45.

4. There shall be kept at the Hall of the Stationers' Company, by the Officer appointed by the said Company for the purposes of the Act passed in sixth year of Her present Majesty, intituled *An Act to Amend the Law of Copyright*, a book or books, entitled 'The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs,' wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work, and no proprietor of any such copyright shall be entitled to the benefit of this Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration.

Certain Enactments of 5 and 6 Vict., c. 45, to Apply to the Books to be Kept under this Act.

5. The several enactments in the said Act of the sixth year of Her present Majesty contained, with relation to keeping the register book thereby required, and the inspection thereof, the searches therein, and the delivery of certified and stamped copies thereof, the reception of such copies in evidence, the making of false entries in the said book, and the production in evidence of papers falsely purporting to be copies of entries in the said book, the application to the Courts and Judges by persons agrrieved by entries in the said book, and the expunging and varying such entries, shall apply to the book or books to be kept by virtue of this Act, and to the entries and assignments of copyright and proprietorship therein under this Act, in such and the same manner as if such enactments were here expressly enacted in relation thereto, save and except that the forms of entry prescribed by the said Act of the sixth year of Her present Majesty may be varied to meet the circumstances of the case, and that the sum to be demanded by the officer of the said Company of Stationers for making any entry required by this Act shall be one shilling only.

Penalties on Infringement of Copyright.

6. If the author of any painting, drawing, or photograph in which there shall be subsisting copyright, after having sold or disposed of such copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding ten pounds; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

Penalties on Fraudulent Productions and Sales.

7. No person shall do or cause to be done any or either of the following Acts: that is to say,—

First, no person shall fraudulently sign or otherwise affix, or fraudulently cause to be signed or otherwise affixed to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram:

Secondly, no person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram, of a person who did not execute or make such work:

Thirdly, no person shall fraudulently utter, dispose, or put off, or cause to be uttered or disposed of, any copy or colourable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work from which such copy or limitation shall have been taken.

Fourthly, where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or otherwise parted with the possession of such work, if any alteration be afterwards made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make or knowingly to sell or publish, or offer for sale, such work or any copies of such work so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Penalties.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding ten pounds, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works shall have been sold or offered for sale; and all such copies, engravings, or imitations, or altered works shall be forfeited to the person, or the assigns, or legal representatives of the person whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid: Provided always, that the penalties imposed by this section shall not be incurred unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed.

Recovery of Pecuniary Penalties.

8. All pecuniary penalties which shall be incurred, and all such unlawful copies, imitations, and all other effects and things as shall have been forfeited by offenders, pursuant to this Act, and pursuant to any Act for the protection of copyright engravings, may be recovered by the person hereinbefore and in any such Act as aforesaid empowered to recover the same respectively, and hereinafter called the complainant or the complainer, as follows:

In *England* and *Ireland*, either by action against the party offending or by summary proceeding before any two Justices having jurisdiction where the party offending resides:

In *Scotland*, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending or by the oath or affirmation of one or more credible witnesses, shall convict the offender, and find him liable to the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding: Provided always, that it shall be lawful to the Sheriff, in the event of his dismissing the action and assoilzieing the defender, to find the complainer liable in expenses, and any judgment as to be pronounced by the Sheriff in such summary application shall be final and conclusive, and not subject to review by advocation, suspension, reduction, or otherwise.

Superior Courts of Record in which any Action is Pending may Make an Order for an Injunction, Inspection, or Account.

9. In any action in any of Her Majesty's Superior Courts of Record at *Westminster* and in *Dublin*, for the infringement of any such copyright as aforesaid, it shall be lawful for the Court in which such action is pending, if the Court be then sitting, or if the Court be not sitting then, for a judge of such Court, on the application of the plaintiff or defendant respectively, to make such order for an injunction, inspection, or account, and to give such direction respecting such action, injunction, inspection, or account, and the proceedings therein respectively, as to such Court or Judge may seem fit.

Importation of Pirated Works Prohibited.—Application in such Cases of Customs Act.

10. All repetitions, copies, or imitations of paintings, drawings, or photographs, wherein or in the design whereof there shall be subsisting copyright under this Act, and all repetitions, copies, and imitations of the design of any such painting or drawing, or of the negative of any such photograph, which, contrary to the provisions of this Act, shall have been made in any Foreign State, or in any part of the *British* dominions, are hereby absolutely prohibited to be imported into any part of the United Kingdom except by or with the consent of the proprietor of the copyright thereof, or his agent authorised in writing; and if the proprietor of any such copyright, or his agent, shall declare that any goods imported are repetitions, copies, or imitations of any such painting, drawing or photograph, or of the negative of any such photograph, and so prohibited as aforesaid, then such goods may be detained by the Officers of Her Majesty's Customs.

Saving of Right to Bring Action for Damages.

11. If the author of any painting, drawing, or photograph, in which there shall be subsisting copyright, after having sold or otherwise disposed of such copyright, or if any other person, not being the proproprietor for the time being of such copyright, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply, or cause to procure to be repeated, copied, or colourably imitated, or otherwise multiplied, for sale, hire, exhibition, or distribution, any such work or the design thereof, or the negative of any such photograph, or shall import or cause to be imported into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be sold, published, let to hire, exhibited, or distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of such work, or the design thereof, or the negatve of any such photograph, made without such consent as aforesaid, then every such proprietors, in addition to the remedies hereby given for the recovery of any such penalties, and forfeiture of any such things as aforesaid, may recover damages by and in a special action on the case, to be brought against the person so offending, and may in such action recover and enforce the delivery to him of all unlawful repetitions, copies, and imitations, and negatives of photographs, or may recover damages for the retention or conversion thereof: Provided that nothing herein contained, nor any proceeding, conviction, or judgment, for any act hereby forbidden, shall effect any remedy which any person aggrieved by such Act may be entitled to either at law or in equity.

Provisions of 7 & 8 *Vict.*, c. 12, *to be Considered as Included in this Act.*

12. This Act shall be considered as including the provisions of the Act passed in the Session of Parliament held in the seventh and eighth years of Her present Majesty, intituled *An Act to Amend the Law relating to International Copyright*, in the same manner as if such provisions were part of this Act.

LIST OF THE PRINCIPAL TEXT-BOOKS ON PHOTOGRAPHY.

[The books mentioned below are obtainable by order of all photographic dealers.]

Burton's Modern Photography. By W. K. Burton. 1*s.*

Early Work in Photography. By W. Ethelbert Henry, C.E. 1*s.*

Guide to Practical Photography. By T. N. Armstrong. 1*s.*

Instruction in Photography. By Sir William Abney. 10th Edition Revised and enlarged. 6*s.*

Science and Practice of Photography. By Chapman Jones. 3*s.* 6*d.*, 2*s.* 6*d.*

Photography with Emulsions. By Sir William Abney, F.R.S. 3*s.*

The First Principles of Photography. By Clement J. Leaper. 5*s.*

Photo-ceramics. Photography applied to the decoration of Plaques, Pottery, and other Ceramic and Metallic Surfaces. By W. Ethelbert Henry C.E., and H. Snowden Ward. 1*s.*

Photographic Enlargements. How to Make Them. By Geo. Wheeler. 1*s.*

Bromide Paper. Instructions for Contract Printing and Enlarging. By Dr. E. A. Just. 1*s.* 6*d.*

Bromide Enlarging and Contract Printing. By S. Herbert Fry. 6*d.*

Negative-making. By Sir William Abney, F.R.S. 1*s.*

Artistic Lighting. By James Inglis. 4*s.* 6*d.*

Instantaneous Photography. By Sir William Abney, F.R.S. 1*s.*

The Lighting in Photographic Studios. By P. C. Duchochois. Revised, with additional matter by W. Ethelbert Henry, C.E. 1*s.*

Chemistry for Photographers. By Charles F. Townsend, F.C.S., F.R.P.S. 1*s.*

Art of Retouching Negatives, and Finishing and Colouring Photograms. By Robert Johnson. 2*s.*

Art of Retouching. By J. Hubert. 1*s.*

Enamelling and Retouching. By Piquepe. Cloth. 1*s.*

Art and Practice of Silver Printing. By H. P. Robinson and Sir William Abney. 2*s.* 6*d.*

Platinotype: Its Preparation and Manipulation. By Sir William Abney and Lyonel Clark. 2*s.* 6*d.*

Lens work for Amateurs. By Henry Orford. 3*s.*

Photographic Optics, a Treatise on. By R. S. Cole. 6*s.*

The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3*s.* 6*d.*

Optics for Photographers. By W. K. Burton. 1*s.*

Photographic Lenses. How to Choose and How to Use. By John A. Hodges. 2*s.*

The Studio and What to Do in it. By H. P. Robinson. 2*s.* 6*d.*

Practical Photo-micrography. By Andrew Pringle. 5*s.*

Photo-micrography. By E. J. Spitta. 12*s.*

Action of Light in Photography. By Sir William Abney. 3*s.* 6*d.*

Encyclopædia of Photography. By Walter E. Woodbury. 7*s.* 6*d.*

Dictionary of Photography. By E. J. Wall. 7*s.* 6*d.*

The Photographic Studio. A guide to its construction, &c. By T. Bolas, 2*s.*

Living Pictures. By H. V. Hopwood. 2*s.* 6*d.*

The Evolution of Photography. By John Werge. Personal chonological reminiscences of nearly half a century. 3*s.* 6*d.*

Photography: Its History, Processes, Apparatus, and materials. By A. Brothers. 21*s.*

The Elements of a Pictorial Photograph. By H. P. Robinson. 2*s.* 6*d.*

Naturalistic Photography. 3rd Edition. Revised, enlarged and rewritten by Dr. P. H. Emerson. 5*s.*

Picture making by Photography. By H. P. Robinson. 2*s.* 6*d.*

Art Photography. By H. P. Robinson. 1*s.*

Practical Essays on Art. By John Burnet. 1. Composition. 2. Light and Shade. 3. The Education of the Eye. 2*s.* 6*d.*

Pictorial Effect in Photography. By H. P. Robinson. 3*s.* 6*d.*

Bichromate Salts in Photography. Six Lectures by Sir William Abney C.B., R.E., D.C.L., J. A. Sinclair, F.R.P.S., W. E. Debenham, J. D. Geddes, W. T. Wilkinson. 1*s.*

Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2*s.*

Wet-collodion Photography. By Chas. W. Gamble. 1*s.*

Art of Photographic Painting. By A. H. Bool. 1*s.*

ABC Guide to Autotype Permanent Photography. By J. R. Sawyer. With Autotype Frontispiece. 2*s.* 6*d.*

Ferric and Heliographic Processes. By G. E. Brown, F.I.C. 2*s.*

Photographic Reproduction Processes. By P. C. Duchochois. A treatise on Photographic Impressions without silver salts. 3*s.* 6*d.*

Tables of Conjugate Foci. For the Users of Photographic Lenses. Compiled and Explained by J. R. Gotz, F.R.P.S. 2nd Edition. 6*d.*

Photo-lithography. By George Fritz. Translated by E. J. Wall. 3*s.* 6*d.*

Photo-engraving. By H. D. Farquhar. 2*s.* 6*d.*

Photo-mechanical Processes. By W. T. Wilkinson. 5*s.*

A Treatise on Photogravure in Intaglio. By the Talbot Klic Process. By Herbert Denison, F.R.P.S. 4*s.* 6*d.*

Photo-aquatint and Photogravure. A Practical Treatise with many Illustrations, and Photo-aquatint Plate by the Author. By Thomas Huson, R.I. 2*s.*

Half-tone Process. On Zinc and Copper. By Julius Varfosser. 2*s.*

Half-tone Process on the American Basis. By Wm. Cronenberg. 2*s.*

Photographic and Photo-mechanical Printing Processes. By W. K. Burton. 4*s.*

Practical Radiography. A handbook of the applications of the X-rays. With Illustrations. The Second Edition, entirely rewritten and up to date. By A. W. Isenthal and H. Snowden Ward. 2*s.* 6*d.*

Optical Projection. A Treatise on the use of the Lantern in Exhibition and Scientific Demonstration. By Lewis Wright. 6*s.*

The Optical Lantern: for Instruction and Amusement. By Andrew Pringle, F.R.M.S. 2*s.* 6*d.*

Figures, Facts, and Formulæ of Photography. 1*s.*

Ilford Manual of Photography. By C. H. Bothamley, F.C.S. 1*s.*

Photography in a Nutshell. By the Kernel. 1*s.*

Science and Practice of Photography. By Chapman Jones 3*s.* 6*d.*

First Principles of Photography. By C. J. Leaper. 2*s* 6*d.*

Photography for the Press. By the Editors of the *Photogram.* 1*s.*

Action of Light in Photography. By Sir Wm. Abney, F.R.S. 3*s.* 6*d.*

First Book of the Lens. By Welborne Piper. 2*s.* 6*d.*

The Lens. By G. E. Brown and Thos. Bolas. 2*s.* 6*d.*

Photographic Optics. By Otto Lummer. Translated by Silvanus P Thompson. 6*s.*

Photographic Optics. By R. S. Cole, M.A. 6*s.*

Practical Pictorial Photography. By A. H. Hinton. 2*s.*

Developers and Development. By G. E. Brown. 1*s.*

Finishing the Negatives. By G. E. Brown. 1*s.*

Carbon Printing. By E. T. Wall. 1*s.*

Lantern Slide Making. By Rev. F. C. Lambert. 1*s.*
The Lantern, and How to Use It. By Goodwin Norton. 1*s.*
Modern Magic Lanterns. By R. Childe Bayley. 1*s.*
Photography in Colours. By Bolas, Tallent, and Senior. 5*s.*
Practical Collotype. By A. W. Fithian. 2*s.* 6*d.*

PRINCIPAL FOREIGN PHOTOGRAPHIC PERIODICALS.

France.

Bulletin de la Société Française de photographie.—Published by Gauthier-Villars et fils, quai des Grands-Augustins, 55, Paris.

Moniteur de la photographie.—Gauthier-Villars et fils, 55, quai des Grands-Augustins, Paris.

Bulletin du Photo-Club de Paris.—40, rue des Mathurins, Paris.

Photo-Gazette.—3, rue Racine, Paris.

Germany.

Photographisches Wochenblatt.—Potsdamerstrasse, 89, Berlin.

Deutsche Photographen Zeitung.—Weimar.

Photographisches Archiv.—E. Liesegang, Dusseldorf.

Photographisches Mittheilungen.—Prof. Dr. H. W. Vogel, 124, Kurfuerstien-Str, Berlin.

Der Amateur Photograph.—Dr. Paul Liesegang, Dusseldorf.

Austria.

Die Photographie.—17, Theresiengasse, Vienna.

Photographische Correspondenz.—Ludwig Schrank, Hautstrasse, 9, Vienna, Austria.

Photographische Rundschau.—Charles Scolik, Paristengasse, 48, Vienna.

Belgium.

Bulletin de l'Association belge de photographie.—M. Ch. Puttemans, palais du Midi, Brussels.

Helios.—103, boulevard de la Senne, Brussels.

United States.

Photographic Times.—423, Broome Street, New York.

Anthony's Photographic Bulletin.—591, Broadway, New York.

American Amateur Photographer.—239-241, Fifth Avenue, New York.

Photo American.—9, East 17th Street, New York.

Photo Beacon.—The Beacon Publishing Company, Tribune Buildings, Chicago, Illinois.

Saint Louis and Canadian Photographer.—2700, Pine Street, Saint Louis Missouri.

Wilson's Photographic Magazine.—853, Broadway, New York.

India.

Journal of the Photographic Society of India.—Calcutta.

St. Veronica.—2, Marquis Street, Calcutta.

Italy.

Bolletino della Società fotografica Italiana.—Via del Giglio, Florence.

Bolletino dell' Associazione degli Amatori di Fotografia.—25, Via Poli Rome.

Dilettante di Fotografia (Il).—Milan.

Revista Scientifico-Artistica di Fotografia.—30, Via Principe Umberto Milan.

Il Progressio Fotografico.—Via S. Maria Sogreta, Milan.

JAPAN.

Sashin Shimpo.

RUSSIA.

Bulletin mensuel de la Société Impériale russe, Section de la photographie, Pantelemenskaja, St. Petersburg.

SWEDEN.

Fotografisk Tidskrift.—Albin Roosval, Stockholm.

SWITZERLAND.

Revue suisse de photographie.—40, rue du Marché, Geneva.

THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

(The following notes are abstracted from the P.P.A. Handbook No. 3.)

FOREWORDS.

The Professional Photographers' Association is the one and only representative body of its kind throughout the British Empire. Its objects are, to improve the status of those who practise photography as a profession; to defend their interests; to assist them by advice; to afford them opportunities for meeting and discussing matters pertaining to the advancement of the craft; and to employ all legitimate means of upholding the rights and dignities of the profession.

In the first year of its existence it has received the active support of between five and six hundred members, and has earned commendation from all parts of the world. Besides its legislative sphere, the Association has its social uses, and it also aims at constituting itself the authoritative governing body of British professional photographers throughout the world.

A vast field of work lies before the Association, in the furtherance of whose objects it is hoped that it will secure the active membership of the many thousands of photographers who have not yet joined.

Officers and Committee of the Professional Photographers' Association.

President.—William Grove.
Past President.—Thomas Bedding, F.R.P.S.
Vice-Presidents.—H. Walter Barnett, W. Crooke, Ernest Elliott.

Committee:

London.—F. A. Bridge, H. J. Dalby, Alfred Ellis, H. Edmonds Hull, M. Jacolette, A. Mackie, Edgar Scamell, G. V. Simmons, Lang Sims, T. C. Turner.

Country.—W. Barry (Hull), H. A. Chapman (Swansea), W. Gill (Colchester), Frank Moffatt (Edinburgh), G. W. Morgan (Aberdeen), H. C. Spink (Brighton), W. D. Valentine, J.P. (Dundee), G. Watmough Webster (Chester), H. J. Whitlock (Birmingham), Alfred Werner (Dublin).

Hon. Treasurer.—William Grove, 63a, Baker Street, London, W.

Hon. Secretary.—Alfred Ellis, 51, Baker Street, London, W.

Hon. Solicitor.—P. E. Marshall, Esq., 62, Lincoln's Inn Fields, London, W.C.

Auditors.—S. H. Fry, 12, South Villas, Camden Square, N.W.; M. B. Barraud, 54, Clarence Street, Kingston-on-Thames.

Bankers.—National Provincial Bank of England.

NOTICES TO MEMBERS.

All communications for the P.P.A. should be addressed to the **Honorary Secretary, 51, Baker Street, London, W.**

Members will greatly oblige by addressing their communications thus:—

Professional Photographers' Association.
ALFRED ELLIS, Hon. Sec.,
51, Baker Street,
London, W.,

to distinguish them from the business letters of Alfred Ellis and Walery.

Members are reminded that their annual subscription became due on July 1st, 1902.

Members are advised, wherever practicable, to become dealers in photographic materials, in order to obviate the unfair competition they are subjected to by shopkeepers, and others, who are not photographers, undertaking the production of portraits, enlargements, etc., which legitimately fall within the sphere of professional photographic work.

⁂ Members desiring legal advice must make application to the Hon. Secretary, Mr. Alfred Ellis, 51, Baker Street, W., who will place the matter before the committee. Application for advice may, however, be made direct to the Association's Hon. Solicitor, Mr. P. E. Marshall, 62, Lincoln's Inn Fields, W.C., but in such cases the Association accepts no responsibility.

⁂ It is suggested by the committee that, on their cards, note headings, invoices, and business stationery, members should print the words, "Member of the Professional Photographers' Association."

Fire Insurance.

In accordance with instructions from the general meeting of the members held on February 7th, the committee have made arrangements with the Fine Art and General Insurance Co., Ltd., of 90, Cannon Street, London, E.C., by which any member may transfer his present policy to this company, and obtain a reduction of 20 per cent. on the premiums hitherto paid. To secure this concession, it will be necessary for the member to forward his policy to the Hon. Secretary, Mr. Alfred Ellis, 51, Baker Street, W. A charge note for the premium will then be sent, holding the insured covered for a period of thirty days to enable the new policy to be prepared.

In cases where the member has not been previously insured, or requires a new policy, it will be necessary to have an accompanying proposal form completed, when the insurance company will allow a discount of 20 per cent. off their usual rates.

Copyright.

The committee, during the past year, having had many applications for advice on copyright matters, make the following suggestions for the guidance of members:—

1. Important.—A copyright photograph is one taken at the photographer's own expense, and for which he does not receive payment or other stipulated consideration. It is recommended that in all cases distinction should be made in members' books between photographs that are charged for, and those for which no charge is made.

2. Registration.—Every copyright photograph should be registered by the proprietor delivering or sending by post prepaid to the Registrar, Copyright Office, Stationers' Hall, London, E.C., a signed memorandum of such copyright, with a fee of one shilling. Special forms, one penny each, containing full instructions of how to register a photograph, can be obtained on application at Stationers' Hall.

3. Necessity of Registration.—No proprietor of a copyright is entitled to the benefit of the Act until registration, and no action can be main-

tained or any penalty recovered in respect of any infringement before registration. In registering, the name of the actual photographer should be inserted as author.

4. Transfer of Negatives.—In all cases where a negative of a photograph is transferred for the first time by the owner to any other person, the copyright will cease to exist, unless at or before the time of such transfer an agreement in writing be signed by the transferee reserving the copyright to the owner, or by the owner transferring the copyright to the transferee as may be the intention of the parties. A member purchasing a business or another photographer's negatives should be careful to see that the copyrights are properly assigned and registered in his own name.

5. Reproductions.—Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, and to formulate their charges accordingly. For example: A newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6in. by 4in., when printed with letterpress in one issue of the paper; but if it is printed as an inset the fee should be at least one guinea. If printed in colours, collotype, or photogravure, it should be a still higher fee. If the photograph is to be reproduced for advertising purposes, a higher fee should be charged than for newspaper work. In all cases, the permission should be in writing, and state the amount of fee to be paid, the process by which the photograph is to be reproduced (whether in black-and-white or colours), the limit size, and the purpose for which the reproduction is to be used.

RULES OF THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

(Founded March 28, 1901.)

1. The Association shall be called "The Professional Photographers' Association."

2. The objects of the Association shall be: ((*a*) To promote the interests of its members in their professional work. (*b*) To watch Parliamentary or public action affecting the interests of Photographers. (*c*) To deal with matters affecting professional custom and practice. (*d*) To co-operate with similar associations for the purpose of securing united action and mutual support in dealing with matters affecting the profession.

3. Membership shall be restricted to persons engaged in the commercial production of photographs, who shall be either in business on their own account, or in partnership, or responsible managers of firms or companies.

4. Professsional photographers may be admitted to membership on the nomination of a member, or on their own application; the Committee shall decide any question as to eligibility.

5. The annual subscription shall be 5*s*. payable on admission, subsequent subscriptions shall be payable in advance on July 1 in each year. No member shall be entitled to any of the privileges of membership if his subscription shall be three months in arrear, and the Committee shall have power to terminate the membership of any one whose subscription is more than six months in arrear.

6. The ordinary meetings of the Association shall be devoted to the discussion of matters concerning the welfare of professional photographers and the profession only; they shall be held on the first Fridays in February, April, June, October, and December. The Committee may call extraordinary meetings when they may think it advisable.

7. All General meetings shall be held in the first week in July, for the purpose of receiving the report of the Committee and the balance-sheet for the past year, the election of Officers, and such other business as may require the decision of a general meeting. Notice of the meeting, together with a ballot paper, shall be sent to every member not less than fourteen days before the date of the meeting. A special general meeting may be called by the Committee at any time. A special general meeting shall be called within fourteen days of the receipt by the Hon. Secretary of a requisition signed by ten members stating the purpose of the meeting. Every member shall receive seven days' notice of a special general meeting, and no subject shall be discussed thereat but that for which the meeting is called.

8. Alterations of the rules shall only be made at the general meetings or a special general meeting. The alterations proposed shall be stated in the notice convening the meeting.

9. At all meetings the vote shall be taken by show of hands unless a ballot be demanded.

10. The Honorary Officers of the Association constituting the Committee shall be a President, Vice-President, Treasurer, Secretary, and twenty ordinary members of the Committee, not more than ten of whom shall be London members. They shall have power to appoint an Assistant Secretary, who may be paid. At meetings of the Committee, five shall form a quorum.

11. The Committee may make such by-laws and regulations, not inconsistent with the rules, as they may from time to time think necessary. They shall also have power to appoint sub-committees for special objects from the members of the Association.

12. The Officers shall retire annually, but shall be eligible for re-election. At a special meeting of the Committee, to be held in the month of May, the Committee shall select by ballot a President, a Vice-President, and twenty-two other members for the new Committee as their nomination. Any member, by letter addressed to the Hon. Secretary not later than May 31, may nominate a President, Vice-President, and not more than twenty-two other members. The Hon. Secretary shall write to each member nominated to any office, asking whether he is willing to serve if elected, and no reply within four days shall be taken to signify acquiescence. A ballot paper shall be prepared containing the names of all the members nominated, and eligible and willing to serve, in alphabetical order, but no other information except that relating to the taking of the ballot. The ballot papers shall be collected at the Annual General Meeting at nine o'clock.

13. At their first meeting the new Committee shall elect a Treasurer from amongst those elected on the Committee. They may appoint any member as Hon. Secretary, notwithstanding such appointment may increase the number of ordinary members of Committee by one. Should any Officer resign, or become incapable of acting, the Committee may fill the vacancy.

14. If ten members shall sign a report to the effect that they consider it desirable that the membership of any member shall be terminated, on account of conduct either tending to bring discredit on the profession or obnoxious to his fellow members, the Committee on receipt thereof shall call a special general meeting to discuss the matter; then if a majority of two-thirds of those present so decide, the offending member shall be expelled.

15. Proper books of account shall be kept by the Treasurer, and a book of minutes of all meetings shall be kept by the Hon. Secretary.

16. The payment of a subscription by a member shall be taken as indicating acquiescence in these rules.

THE AFFILIATION OF PHOTOGRAPHIC SOCIETIES.

[Reprinted from the Photographic Red Book.]

Officers:—Chairman: The Right Hon. the Earl of Crawford, K.T., F.R.S.; Executive Committee: Robert Beckett, F.R.P.S. (Hackney); C. Churchill, F.R.P.S. (Woolwich); John F. East (Kingston-on-Thames); Walter Kilbey (N.W. London); A. Mackie (London and Provincial); E. Marriage, F.R.P.S. (Woodford); J. C. S. Mummery (North Middlesex); C. H. Oakden, F.R.P.S. (South London); H. C. Rapson (London and Provincial); W. R. Stretton (Photographic Club); Hon. Treasurer: George Scamell, F.R.P.S.; Auditors: F. W. Bannister (Borough Polytechnic); W. H. Wilshere (West Surrey); Secretary: A. W. W. Bartlett, 66, Russell Square, London, W.C.

Benefits and Privileges.

Affiliated Societies are entitled to the following benefits and privileges:—

The loan of illustrated lectures on photographic and kindred topics, sets of lantern slides, lantern lectures, pictures for exhibition, etc.

Permission to photograph in the places specified on page 5, upon production of this issue of the Photographic Red Book, without special application to the various authorities.

Two copies of each issue of the Photographic Journal, in which are published the proceedings of the Affiliation Committee and the transactions of the Royal Photographic Society of Great Britain.

Reduced rates for wall space and admission at the annual exhibition of the Royal Photographic Society of Great Britain.

Members of affiliated Societies joining the Royal Photographic Society of Great Britain receive exemption from the payment of entrance fee, provided they have been for at least two years members of an affiliated Society. The secretaries and delegates of affiliated Societies are empowered to propose and second the nominations of such candidates.

The services of a board of judges in respect of small Society competitions. Details are given on page 24.

Temporary use of the accommodation provided by the various Societies to members away from their own districts. Details are given, commencing page 28.

Management.

Every affiliated Society has a voice in the management of the affiliation through the two delegates which each is entitled to appoint. The general body of delegates meets, as a rule, but once a year, the business in the meantime being conducted by an executive committee appointed under the provisions of Rule 6. The two delegates appointed by each Society need not necessarily be members of the Society they represent. The Royal Photographic Society of Great Britain reserves one-third of the amount of the subscriptions for secretarial, clerical, and incidental working expenses. The Affiliation Committee have the remaining two-thirds entirely at their disposal.

Rules.

(1) Affiliation shall be by the council of the Royal Photographic Society of Great Britain.

(2) All Societies interested in photography, whether London, provincial, colonial, or foreign, shall be eligible for affiliation.

(3) The object of the affiliation shall be to consider and suggest lines of action to the affiliated Societies, and to take any steps it may think

fit to encourage or otherwise benefit them. Each affiliated Society shall be entitled to appoint two delegates, who, in conjunction with three members to be appointed by the Royal Photographic Society of Great Britain, shall form the Affiliation Committee, with the right to vote in all matters in which the committee may deal.

(4) The committee shall have the power to make the necessary rules for the conduct of the different branches of its work, and, subject to fourteen days' notice in writing to each delegate, such rules may be altered, added to, or revoked at the annual general meeting or at a special general meeting. All such rules and alterations shall be submitted to the council of the Royal Photographic Society of Great Britain, and be approved by it before they come into force.

(5) The committee shall meet at such time and place as the chairman shall decide. On the requisition of ten delegates the secretary shall call a meeting, not less than fourteen nor more than twenty-one days after receipt thereof. At committee meetings nine shall form a quorum.

(6) The committee shall have power to nominate certain of their number to form an executive. The executive shall have power to make such regulations, not inconsistent with the rules, as may from time to time be deemed necessary.

(7) Upon the request of two-fifths of those present at any meeting of the executive, the votes of the committee shall be taken in writing upon any subject, otherwise proxy voting shall be inadmissible.

(8) The subscription shall be one guinea, payable on admission, and subsequently in advance on January 1st in each year. Any Society whose subscription may be three months overdue shall be suspended from affiliation, and if at the end of twelve months the subscription remain unpaid the defaulting Society shall cease to be affiliated, but may be reinstated by the council after satisfactory explanation.

(9) A balance-sheet of the accounts of the affiliation shall be prepared by the treasurer up to December 3rd in each year, and shall be audited by two auditors. The annual general meeting of the committee shall be held during January in each year. At this meeting the balance-sheet, duly audited, and the chairman's report of the year's proceedings shall be submitted, and officers, consisting of a chairman, treasurer, and two auditors, shall be elected for the current year.

INTERCHANGE OF LECTURES.

The committee are enabled to publish below the names of a number of members of affiliated Societies who have signified their readiness to lecture before other affiliated Societies in exchange for a similar courtesy to their own from a member of the Society obliged by them. This system of exchange has been the means of lending much additional interest to many programmes, and the committee trust that full use will be made of the lectures here offered. The number of lectures available is still small, but it is hoped that every Society will endeavour to make an offer of the services of at least one of its members, and so assist the committee in organising a body of lecturers to whom the Societies may look for help in the not easy task of filling up their programmes. The committee feel that it is perhaps superfluous to intimate that everything should be done to render the visits of these lecturers as pleasant as possible, by receiving and looking after them during the time that they are devoting to the Society whose wants they are attending to. Expenses should, of course, be tendered in all cases. Special allusion is made to the reception of lecturers, because instances of neglect have been brought to the notice of the committee, who feel sure that they have only to briefly refer to the few isolated cases of negligence to ensure the correct treatment of lecturers in future. Applications for the lectures specified below should be addressed to the Society under whose auspices the offers are made, and the applicant should state what is offered in exchange. It is understood, of course, that the committee accept no responsibility whatever in regard to these offers, and that they may be modified or revoked at the pleasure of the Societies making them.

Offers have been received from the following:—

Blairgowrie and District Photographic Association.—Mr. John B. Maclachlan.

Brentford Photographic Society.—Mr. A. R. Read, jun., on (1) The First Principles of Pictorial Composition; (2) The Practical Side of Pictorial Composition.

Cornish Camera Club.—The hon. sec. on "Enlarging"; and others.

Dover Sciences Society.—Lectures on Natural History and kindred subjects.

Ealing Photographic Society.—The hon. sec. is prepared to receive any suggestions from other Societies involving reciprocity.

Eastbourne Photographic Society.—Mr. J. J. Hollway, Mr. H. S. Bullock, Mr. Ellis Kelsey, Mr. H. Habgood, and Mr. E. J. Bedford are prepared to lecture.

East Kent Natural History and Photographic Society.—Mr. A. Lander on "Colour Photography," "Telephotography," etc.

Edinburgh Photographic Society.—Suggestions will be considered.

Fakenham Literary, Field, and Camera Club.—The hon. sec., on a variety of subjects.

North-West London Photographic Society.—Mr. Walter Kilbey is prepared to deliver his affiliation lecture on Focal-Plane Shutter Work, and to bring apparatus and additional slides. He also offers the following lectures:—"A Week-end on the Continent," "Through Northern France with a Hand Camera," and "Some Green Bits in the Emerald Isle." Mr. A. J. Reid on "Sunny Memories of Normandy."

Plymouth Photographic Society.—Mr. W. C. Johns on "A System of Lantern-Slide Making by Contact and Reduction."

Rotherham Photographic Society.—Mr. James Leadbeater on 'Lightning, and How to Photograph It."

South London Photographic Society.—Mr. Frank Goddard.

Sunderland Photographic Association.—Mr. T. Fitzgibbon Forde on "Trimming, Mounting, and Framing."

West Surrey Photographic Society.—Mr. W. H. Wilshere on "Photography at the Zoo," with slides. Others might be arranged.

Woodford Photographic Society.—Mr. Ernest Marriage, F.R.P.S., on "Architectural Photography." Mr. H. T. Malby, F.R.P.S., on "Flower Photography" (affiliation lecture, with additional notes and slides), and "Rambles through Epping Forest," with slides. Mr. J. P. W. Goodwin on "The Making of Enlarged Negatives." Mr. J. T. Ashby on "Pictorial Composition," with slides.

Woolwich Photographic Society.—Mr. W. H. Dawson on Chemical or Architectural subjects.

PLACES TO PHOTOGRAPH.

The following information has been kindly furnished by the secretaries of the affiliated Societies, and it is hoped that its publication may prove of use to a large number of the members:—

Airdrie.—Monkland Glen, Calder Glen, Cleddans.

Arbroath.—Abbey (free), cliffs, coast scenery.

Beaconsfield (Bucks).—Burnham Beeches, three miles. Stoke Pogis

Church, five miles. Burial Place of William Penn, three miles. Milton's Cottage, Chalfont, four miles.

Birmingham.—The Warwickshire Avon flows through or by the towns and villages of Stoneleigh, Warwick, Stratford, Bidford, Evesham, Pershore, and Tewkesbury, and affords innumerable opportunities for pictorial work. The district teems also with photographic subjects of all descriptions, and not least from an historical standpoint.

Blairgowrie.—The district is full of "pictures." Cluny Loch, Muirton of Ardblair, Meekleour Village, Craighall House and Grounds are a few of the more important places. Craighall Grounds are open to the public on Tuesdays and Fridays. On other days (Sundays excepted) a permit can be obtained at the Railway Station for a small sum, which is handed by the proprietor to Perth Infirmary.

Brentford (Middlesex).—The River Brent, the Canal, the Thames from Strand-on-the-Green to Isleworth, Greenford, and Perivale. Fine evening effects may be obtained at Isleworth, especially at low tide.

Brierley Hill.—Dudley Castle (free), Halesowen Abbey and Church.

Bury St. Edmunds.—A good photographic district, no prohibitions.

Canterbury.—The Cathedral and town.

Cardiff.—The Castle and Grounds. Permission at the Bute Estate Office (admission 1s.).

Carlisle.—Wetheral, Wreay, Lanercost, the Castle, and Cathedral.

Cheltenham.—Gloucester Cathedral, Tewkesbury Abbey.

Chester.—Eaton Hall (the residence of the Duke of Westminster), Hawarden, the Cathedral, the River, Walls and City, St. John's Church.

Croydon.—Croham Hurst, West Wickham Woods, Addington Hills.

Derby.—Chatsworth, Haddon, the Peak District, Dovedale, Lichfield Cathedral, Darley Dale, and Matlock.

Dudley.—The Castle and Grounds (free).

Dundee.—Arbroath, Abbey and Cliffs, Fife Coast, St. Andrews.

Eastbourne.—Michelham Priory, Hurstmonceux Castle, Parish Church (Norman work), Alfriston and Valley of the Cuckmere, Beachy Head, Cliffs, and Birling Gap.

Exeter.—Cathedral, Bishop's Palace and Deanery, Rougemont Castle, Powderham Castle, old churches, old buildings, and halls. River scenery on Exe, Teign, Daw, and Dart. Country residences, Dartmoor, Teignmouth, Dawlish, Exmouth, Torquay.

Fakenham.—Walsingham Abbey Ruins, five miles (G.E.R. Station at Walsingham). Apply to H. Lee-Warner, Esq., J.P., The Abbey, on Wednesdays only. East Barsham.—Fine specimen of a Tudor Manor House, three-and-a-half miles; apply to W. R. H. Garland, Esq., The Manor House, East Barsham. Thorpland Hall, two miles.—Tudor, with very fine chimneys. Apply to Rev. J. Lee-Warner, at the Hall. Houghton St. Giles, four miles, one mile from Walsingham Station.—The Church contains a fine old illuminated rood screen. A beautiful little wayside Chapel, now belonging to the Benedictine order, later decorated style of 14th century; formerly a resting-place for pilgrims on their way to the shrine of Our Lady of Walsingham. Apply, for Church, to Rev. H. A. Wansborough, Rector of Walsingham. Great Snoring, four miles.—Fine ornamental brickwork of Rectory; built by Sir Ralph Shelton. Apply to Rev. R. P. Roseveare, Rectory, Snoring. Various old manor houses and picturesque river scenery. Particulars from secretary at any time.

Glenalmond (Perthshire).—The Perthshire Highland, the Sma' Glen, many ancient monuments, Crieff, Dunkeld, Falls of Menzie, etc. No per-

Hove.—Alfriston, Bramber, Barcombe Mills, Shoreham Harbour, up the Arun from Arundel, the country round Bosham, some good Churches

mits required.

in neighbourhood, especially Old and New Shoreham (Norman). Apply to the Vicar.

Ipswich.—Particulars of excursions gladly supplied by the secretary of the Ipswich Society.

Isle of Man.—Numerous Glens, the best being Glen Maye, Glen Auldyn, Sulby, Ballaglass, Dhoon, Glen Helen, and upper parts of Grondle, Fine coast scenery between Port St. Mary and Peel (including the Calf of Man), at Garwick Beach, and from a rowing boat between Laxey and Dhoon.

Isle of Wight.—Throughout the island.

Kingston-on-Thames.—The river, Hampton Court and Park, Richmond Park, Oxshott Common.

Leicester.—Bradgate Park and Ruins.

Newcastle-on-Tyne.—Jesmond Dene, Tynemouth, River Tyne and shipping, the Upper Tyne, and surrounding country.

Oxford.—The various colleges and halls, churches, and museums. Panoramic views of Oxford from the cupola of the Sheldonian Theatre and the roof of Bodleian Camera.

Ramsgate.—Seascapes, and, at a short distance, Canterbury, Minster, Sandwich. Cattle studies in the Marshes. Permission readily obtainable.

Rotherham.—Roche Abbey, seven miles, open to public on Monday and Thursday. Conisbro' Castle, eight miles, open daily; no fee except to inside of Norman Keep, which contains two notable fireplaces and chapel.

St. Albans.—The Abbey (apply the Dean), Hatfield House (very special permit only), town and neighbourhood rich in architectural and natural beauties.

Severn and Wye.—The Wye Valley from Ross to Chepstow.

Slough.—Burnham Beeches, Windsor Castle (Inspector Stephens, at the Castle), Eton College (the Bursar), Stoke Poges, Dropmore.

Southport.—The streets, parks, and gardens, and Ormskirk, Sefton (old church), Parbold, Appley Bridge.

Southsea.—By road: Porchester Castle (ruins) and Norman church (permit of vicar). Hayling Island.—Good landscape work and Early English church. Bosham.—Quaint old fishing village (Early English church). Titchfield.—Place House, Leigh Park. By rail: Southampton.—Docks, shipping, yachts, and the Solent. Beaulieu.—Abbey ruins; the New Forest. Netley.—Abbey ruins and beautiful surrounding country. Bursledon.—Good shipping studies at low tide. Winchester.—Cathedral, Castle, Cross, and old streets. Chichester.—Cathedral (Red Book.) Market Cross and old gates. The Canal and Goodwood. Arundel.—The Castle and Deer Park (permit of Duke of Norfolk). Views on River Arun. Bognor and Littlehampton. Cowdrey Castle (ruins), and beautiful country round. Midhurst, Petersfield, Rogate, Harting, and the South Downs. By water: Shanklin, Ventnor, Newport, Ryde, and Cowes. Bournemouth and Southampton. Fine shipping and yachting views. Portsmouth and Southsea teem with places and objects of historic interest, new and old battleships in harbour, the Town Quay (fishing boats and colliers). No camera is allowed in Portsmouth Dockyard without an order from the Admiral Superintendent.

Stonehouse (Devon).—St. George's Church (apply Vicar), Royal Naval Hospital (apply Inspector-General), Royal Marine Barracks (apply Officer in Command).

Stratford (London, E.).—Epping Forest, Wanstead Flats and Park, Whipps Cross, Waltham Abbey (permit from Vicar), Waltham Cross, and Temple Bar.

Sunderland.—The Docks and shipping.

Swansea.—Old castle of Oystermouth, Pennard, Penrice, etc., the Gower Peninsula and coast.

Tunbridge Wells.—Penshurst Place, Hever Castle, Chiddingstone Ruins, Bayham Abbey, and the Commons.

Weymouth.—Portland, Radipole, Moreton, Lulworth, etc.

York.—The Minster, St. Mary's Abbey, the City Halls and Bars, Kirkham Abbey, etc.

The following information is compiled from various sources. The secretary will be glad to be notified of any inaccuracies:—

London and District:

Bethnal Green Museum.—Secretary, Science and Art Department, South Kensington, S.W.

Botanical Gardens, Regent's Park.—The secretary.

British Museum. The Chief Librarian. Applications must specify the objects to be photographed, and the name and address of the photographer.

Bushey Park.—Production of Red Book.

City Companies' Halls.—The respective Clerks.

Green Park.—Production of Red Book.

Greenwich Park.—Production of Red Book.

Guildhall.—City Lands Committee, Guildhall, E.C.

Guildhall Art Gallery.—Library Committee, Guildhall, E.C.

Hampton Court Park, Gardens, and Green.—Production of Red Book.

Hyde Park.—Production of Red Book.

Highgate Woods.—Production of Red Book.

Houses of Parliament.—Lord Chamberlain's Office, House of Lords, S.W.

Imperial Institute.—The secretary.

Kensington Gardens.—Production of Red Book.

Kew Green.—Production of Red Book.

Kew Gardens.—The Director. Photographing is not allowed on Sundays, Christmas Day, Good Friday, and Bank Holidays.

Kilburn, Queen's Park.—Production of Red Book.

National Gallery.—The Director. Professionals only are allowed to photograph.

Natural History Museum Gardens.—Production of Red Book.

Parliament Square Gardens.—Production of Red Book.

Primrose Hill.—Production of Red Book.

Parks and Open Spaces under the control of the London County Council.—No permission is required for the use of hand cameras. The London County Council, Spring Gardens, S.W., grants permits for twelve months for the use of stand cameras.

Public Record Office.—Secretary, Public Record Office, Chancery Lane, W.C.

Regent's Park.—Production of Red Book.

Richmond Park and Green.—Production of Red Book.

St. Bartholomew's Church, Smithfield.—Fee, 2s. 6d.

St. James's Park.—Production of Red Book.

St. Paul's Churchyard.—Production of Red Book up to 12 noon.

South Kensington Museum.—Secretary, Science and Art Department, South Kensington, S.W.

Tate Gallery.—The Keeper, National Gallery of British Art, Millbank, S.W.

Tower of London.—The Constable of the Tower.

Victoria Tower Gardens.—Production of Red Book.

Zoological Gardens, Regent's Park.—Upon production of the Red Book for current year.

Provinces:

Aston Hall, Birmingham.—Mr. Whitworth Wallis, Art Gallery, Birmingham.
Beverley Minster.—The Rector.
Burnham Beeches.—Production of Red Book.
Cambridge College.—The Masters or Fellows, except for Trinity College, where the book at the Porter's Lodge is signed.
Chatsworth House.—The Duke of Devonshire.
Chepstow Castle.—Admission 4d.
Christchurch Priory.—The Rector.
Coulsdon Common.—Production of Red Book.
Farthingdown.—Production of Red Book.
Fountain's Abbey.—Fee, 1s.
Haddon Hall.—Fee 6d., in addition to admission fee.
Hardwick Hall, Derbyshire.—The Duke of Devonshire.
Hastings Castle.—Fee 3d.
Jervaulx Abbey, Yorks.—Admission 6d., no restrictions.
Kenley Common.—Production of Red Book.
Little Moreton Hall, Cheshire.—Fee 1s.
Ludlow Castle, Shropshire.—Entrance fee of 4d. covers photography.
Manchester, Cheetham's Hospital and Library.—The Master.
Oxford Colleges.—The Master or Dean.
Raglan Castle.—Fee for photographing 2s. 6d., and admission fee 6d.

Lectures on the following subjects will, it is hoped, soon be ready for circulation:—

The Management of Photographic Chemicals. By Mr. Thomas Bolas.
The Ozotype Process. By Mr. Thomas Manly.
Photo-Micrography. By Mr. T. E. Freshwater, F.R.P.S. Negotiations for lectures on the following topics are in hand:—
The Selection of a Printing Process.
The Processes of Colour Photography.
Zoological Photography.
Composition, Light, and Shade.
Platinotype Printing.
Stereoscopic Photography.
Gum-Bichromate Printing.

The copyright in the above lectures is the property of the Affiliation of Photographic Societies. It is impossible to secure the regular and satisfactory lending of the lecture unless the regulations indicated below are strictly complied with. Secretaries of affiliated Societies are, therefore, in their own interest, asked to give them their very careful attention.

Lectures and slides are lent to affiliated Societies on the following conditions:—

1. That they shall not be copied, printed, or published, but shall be read or shown before the Society on the date fixed for the purpose, and shall be forwarded to the address and in the manner indicated by the secretary of the Affiliation.

2. That the accompanying slides or examples are repacked securely in the order in which they are intended to be shown, and that any injury which they may have received previous to reception, not already indicated, be at once notified to the secretary, and the attention of the carriers called to the injury, if such appear to have occurred in transit.

3. That no letters or communications intended for the secretary be inclosed with the lecture.

4. That when it be necessary that one slide remain long on the screen the light be lowered to lessen the risk of damage.

PHOTOGRAPHIC SURVEY AND RECORD OF SURREY.

(INAUGURATED MAY, 1902.)

OBJECT.—"The work of the association shall be to preserve, by permanent photographic process, records of antiquities, anthropology, buildings of interest, geology, natural history, passing events of local or historical importance, portraits of notable persons, old documents, rare books, prints, maps, and scenery, so as to give a comprehensive survey of what is valuable and representative in the county of Surrey."—Rule 2.

PRESIDENT:

The Right Hon. Viscount Midleton, Lord Lieutenant, County of Surrey.

VICE-PRESIDENTS.

The Right Hon. C. T. Ritchie, M.P.
H. C. Leigh-Bennett, M.P.
Sir Frederick L. Cook, Bart., F.R.G.S., D.L., M.P.
Charles Ernest Tritton, M.P.
John Burns, M.P., L.C.C.
Percy Melville Thornton, M.P.
R. K. Causton, M.P.
J. Macdona, M.P.
T. J. Macnamara, LL.D., M.P.
Wm. Keswick, M.P., J.P., D.L.
Edward J. Halsey, C.A., J.P., Chairman Surrey County Council.
Alderman Howarth Barnes, J.P., Mayor of Battersea.
Col. Samuel B. Bevington, V.D., J.P., Mayor of Bermondsey.
W. Scott-Scott, J.P., Mayor of Camberwell.
N. Page, J.P., Mayor of Croydon.
A. F. Asher, J.P., Mayor of Guildford.
C. Burgess, J.P., Mayor of Godalming.
J. White, LL.D., J.P., Mayor of Lambeth.
W. E. St. L. Finny, M.D., J.P., Mayor of Kingston-upon-Thames.
F. Redman, J.P., Mayor of Southwark.

RULES.

1.—This Association shall be called "The Photographic Survey and Record of Surrey."

2.—The work of the Association shall be to preserve, by permanent photographic process, records of antiquities, anthropology, buildings of interest, geology, natural history, passing events of local or historical importance, portraits of notable persons, old documents, rare books, prints, maps, and scenery, so as to give a comprehensive survey of what is valuable and representative of the county of Surrey.

3.—The Association shall consist of photographic and other societies and individual members, with a president and vice-presidents.

4.—Societies, or individual candidates, for election as members, shall be proposed by any member or delegate. The election is vested in the council, and the subscription shall be two shillings and sixpence per annum for each delegate sent by a society, and member.

5.—The business of the Association shall be transacted by a council, which shall consist of a chairman, local vice-chairman, hon. secretaries (survey and general), hon. treasurer, hon. curator or curators, not more than two delegates from each associated society, and not less than six ordinary members.

6.—The annual general meeting shall be held in March, when a report and audited statement of accounts for the year ending December 31st preceding shall be submitted, and the president, vice-presidents, officers, and auditors, and non-delegate members of the council shall be elected for the ensuing year. Voting shall be by ballot. Nominations shall be in writing and signed by at least two members, and shall be in the hands of the hon. general secretary seven clear days before the meeting; but societies shall elect their own delegates.

7.—At every general meeting, the chair shall be taken by the president, or, failing him, by a vice-president, or, if no vice-president be present, the chairman shall be appointed by the meeting.

8.—Meetings of the council shall be held quarterly, and at such other times as may be necessary. Five shall form a quorum. The council shall have authority to appoint special committees with power to add to their number.

9.—In the event of the death or resignation of any officer or other member of the council, the council shall have power to fill the vacancy, except in the case of a delegate of a society, when that society shall appoint a successor.

10.—*Photographs (including lantern slides) shall be approved by the council before acceptance. Prints must be sent in unmounted, or on the regulation mounts.

11.—These rules shall be altered only at an annual meeting, or at a special meeting convened for the purpose, and notice of any alteration shall be sent out with the circular convening the meeting fourteen clear days before the date thereof.

12.—The general secretary, by direction of the council, or on the written request of not less than ten members, specifying the business, shall convene a general meeting, not later than four weeks after receipt of such direction or request.

NOTES.

(a) *The copyright of a photograph remains the property of a contributor, unless specially ceded to the Association.

(b) A register will be kept by the hon. survey secretary of the names and addresses of contributors who are willing to sell or supply copies of their prints to those applying for them.

COUNCIL:

Chairman: W. Whitaker, B.A., F.R.S., F.G.S.

Local Vice-Chairmen: Hector Maclean, F.G.S., F.R.P.S., President Croydon Camera Club; J. Bulbeck, Vice-President West Surrey Photographic Society.

Hon. Treasurer: W. W. Topley, 3, Marlborough Road, Croydon.

Hon. Curator: L. Stanley Jast, Chief Librarian, Croydon Public Libraries.

Elected Members: W. Watts, M.A., Prof. of Geology, University of Birmingham; J. J. H. Teall, M.A., F.R.S., P.G.S.; Prof. J. W. Judd, C.B., LL.D., F.R.S., F.G.S.; H. Keatley Moore, B.A., B.Mus.; Councillor J. Noaks; G. W. Moore; C. L. Faunthorpe; J. H. Baldock, F.C.S.; A. Roods; G. Clinch, F.G.S.; Alderman F. Foss, J.P.; E. Mawdesley, B.A., LL.B., Town Clerk, Croydon; J. Epps, jun., F.L.S., President Croydon Nat. Hist. and Scientific Society.

Delegated Members: B. H. Winslow, E. L. Curtis, Norwood Natural Science Society; W. Wood, W. H. Rogers, Thornton Heath Photographic Society; E. Gane Inge, E. W. Eele, Haslemere Nat. Hist. and Micro. Society; E. Salt, H. M. Bennett, Croydon Camera Club; N. F. Robarts, F.G.S., Croydon Nat. Hist. and Scientific Society; R. Hovenden, F.S.A., S. W. Kershaw, M.A., F.S.A., Brit. Arch. Association; M. S. Giuseppi, F.S.A., W. Bruce Bannerman, F.S.A., F.G.S., Surrey Arch. Society; A. C. Haddon, F.R.S. (Pres.), J. Gray, B.Sc., Anthropological Institute; E. A. Martin, F.G.S., Croydon and Norwood Branch Selborne Society; C. Thwaites, Sutton Photographic Club; H. W. Monckton, F.L.S., F.G.S., W. P. D. Stebbing, F.G.S., Geologists' Association; G. R. Beckett, G. Robinson, South Norwood Photographic Society; W. H. Wilshere, West Surrey Photographic Society; R. Quick, M.I.S., Dulwich Scientific and Literary Association; H. G. Quarterman, Society of Architects; F. W. East, Kingston-upon-Thames and District Photographic Society; J. J. Coleman, F. Sears, Clapham Junction Y.M.C.A. Natural Science Circle; W. Coomer, W. J. Wilson, Croydon Y.M.C.A. Camera Club; F. R. Taylor, E. W. M. Wonnacott, Architectural Association Camera and Cycling Club; J. M. Hobson, M.D., B.Sc., Croydon Antiquities Protection Committee.

Hon. Secretaries: Survey, H. D. Gower, 55, Benson Road, Croydon; General J. M. Hobson, M.D., B.Sc., 1, Morland Road, Croydon.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

THE following is the Lecturers' List for 1903-1904:—Alex. Adams, Douglas Terrace, Stirling, "A Trip to Italy," illustrated by lantern slides. Arch. Campbell, Stewart Terrace, Barnhill, Broughty Ferry, "The Reproduction of a Photograph," being a description of the various methods of newspaper and book illustration, illustrated by examples. (Not more than three times during session.) Henry Coates, Pitcullen House, Perth, "Snapshots in the Rocky Mountains," illustrated by lantern slides. Rev. John Crouch, Bridge of Weir, "Through North and North-Western France with a Camera," "The Engadine and the Italian Lakes." Lantern slides for above two lectures by T. H. Taylor, L.D.S. J. W. Eadie, Lenidale, Airdrie, "Mounts and Mounting," illustrated by prints and samples; "Composition," illustrated by diagrams; "Pictorial Record (Official) of the Glasgow Exhibition," illustrated by 200 slides. W. D. M. Falconer, James Street, Blairgowrie, "Photographic Optics for Beginners," illustrated by diagrams. Blackboard and coloured chalks required. W. B. Hossack, Deveron Bank, Airdrie, "Stereo-Photography," illustrated by specimens, prints, and apparatus. G. Jack, Wellington Street, Airdrie, "In and Around Glasgow Cathedral," illustrated by 75 lantern slides. John Kirk, 1, Infirmary Street, Brechin, "Lies Told by the Camera," illustrated by lantern slides. John B. Maclachlan, Blairgowrie, "From Castle to Palace" (Old Edinburgh), illustrated by over 50 lantern slides. J. Wilson Paterson, U.F. Manse, Airdrie, "A Tour Through Norway," illustrated by 120 lantern slides; "Switzerland and the Rhine Valley," illustrated by 150 lantern slides. Wilton Rix, Claremont Gardens, Milngavie, "Some Methods," illustrated by prints, etc. James L. Scott, 99, Commercial Street, Dundee, "A Rambler's Impressions: Scenes by the Way," illustrated by lantern slides. S. Stewart, 2, Salisbury Place, Kirkcaldy, "A Week in Holland, with the Hand Camera," illustrated by 100 lantern slides.

Demonstrations.—Vaness C. Baird, Broughty Ferry, "Carbon," 1/1 dishes, hot and cold water required. J. W. Eadie, Lenidale, Airdrie, "Platinotype," "Carbon," "Ozotype." Thos. Lupton, Abercromby

Place, Stirling, "Lantern Slide Making." G. D. Macdougald, Shore Terrace, Dundee, "Gum-Bichromate Printing." Wilton Rix, Claremont Gardens, Milngavie, "Carbon Printing."

Lectures for Circulation.—Vaness C. Baird, Broughty Ferry, "Short Notes on a Tour in Normandy," illustrated by 60 lantern slides. W. D. M. Falconer, James Street, Blairgowrie, "Photographic Optics for Beginners," illustrated by diagrams.

Lantern Slides for Circulation.—Alex. Adams, Douglas Terrace, Stirling, "A Trip on the French Riviera," "A Tour Through Norway." Vaness C. Baird, Broughty Fery, "Norway" (80 slides). Thomas Lupton, Abercromby Place, Stirling, "A Tour Through 'The Raiders' Country," "A Trip to St. Kilda." W. C. Shaw, 18, Forth Street, Stirling, "Robert Burns."

The regulations state that invitations should be sent direct to the authors. Stamped envelopes should, in all cases, be enclosed for reply. The expenses of each lecturer or demonstrator must be paid to him on the evening of the lecture; and it is expected that the society will provide hospitality when the return journey is impossible or inconvenient on the same night. In the case of the loan lectures and slides, carriage must be paid both ways by the society, and the lecture or slides must be returned on the morning following the meeting for which they were obtained. Each lecture, demonstration, or set of slides must be acknowledged on the society syllabus as "The Scottish Photographic Federation Lecture" Demonstration or Lantern Slides. It is understood that the society making the engagement provides the lantern or appliances required. A reading lamp must always be provided for the use of the lecturer when a lantern is necessary.

LANTERN SLIDE COMPETITION, 1904.

RULES.

1. The competitions shall be open to the Federated Societies and Associates.
2. Each set for the Associates' Competition shall consist of three slides, the unaided production of the competitor. The Associates' nom-de-plume and slide numbers must be marked in black ink, legibly on each slide.
3. There is no limit to the number of sets entered by each society or Associate, but only one prize can be gained by a competitor.
4. There is no restriction as to subject.
5. Entry is free.
6. The judges shall award such marks as they think proper to the competing sets. The competitor gaining the highest number of marks shall be awarded the first prize, the competitor gaining the second highest number of marks the second prize, and so on should the Council decide to award more than one prize.
7. The sets sent in by a society shall consist of eighteen slides, contributed by not less than three members of such society, and the best set shall be awarded the "Society Prize." Slides which are in competition for Associates' Prizes may be included in these sets. All slides must be marked with society's nom-de-plume, and slide numbers in red ink, legibly on each side.
8. All competing slides must be in the hands of the secretary, carriage paid, not later than January 15, 1904.
9. The Council reserves the right to select from the competing slides one or more series for circulation amongst the federated societies.
10. No mark or otherwise indicating the identity of the competitor shall appear on the slides. Each entry must be accompanied by a sealed envelope, with nom-de-plume outside, and name of competitor enclosed.

THE ARTISTIC COPYRIGHT SOCIETY.

PRESIDENT.—*Sir Lawrence Alma-Tadema, R.A.

ACTING VICE-PRESIDENT.—*Frank Dicksee, R.A.

HONORARY VICE-PRESIDENTS.—E. A. Abbey, R.A., Sir William Agnew, Bart., Sir Walter Armstrong, F. R. Daldy, Sir T. Drew, P.R.H.A., Dr. Farquharson, M.P., Peter Graham, R.A., James Guthrie, P.R.S.A., Sir Alex. Henderson, Bart., M.P., Professor Von Herkomer, R.A., T. G. Jackson, R.A., B. W. Leader, R.A., John Murray, Sir E. J. Poynter, P.R.A., Sir Cuthbert Quilter, Bart., M.P., Briton Riviere, R.A., J. S. Sargent, R.A., Sir Benjamin Stone, M.P., T. Humphry Ward, J. W. Waterhouse, R.A., Sir E. A. Waterlow, P.R.S.W., A.R.A., Lord Windsor, P.C.

GENERAL COMMITTEE.—*George W. Agnew (Chairman), Lockett Agnew, *Edwin Bale, R.I., Francis Bate, Sir Wyke Bayliss, P.R.S.B.A., Frank Bishop, G. H. Boughton, R.A., H. Scott-Bridgwater, Thomas Brock, R.A., Walter Dowdeswell, *Luke Fildes, R.A., A. C. Gow, R.A., Algernon Graves, F.S.A., *J. F. E. Grundy, O. Gutekunst, A. H. Haig, R.E., W. Hatherell, R.I., E. B. Haynes, Marcus B. Huish, Seymour Lucas, R.A., J. Macwhirter, R.A., W. Q. Orchardson, R.A., *Joseph B. Pratt, T. E. Scrutton, K.C., Cyril Spottiswoode, W. Reynolds-Stephens, Carmichael Thomas, Alexander Tooth, Adolph Tuck.

SOLICITOR.—Herbert Voysey.

HONORARY TREASURER.—*C. Morland Agnew.

HONORARY SECRETARY.—*D. C. Thomson.

ASSISTANT SECRETARY.—John Major.

* These form the Executive Sub-Committee.

Artistic Copyright.—To everyone interested in the fine arts it is evident that the scope and value of the rights of reproduction in artistic work have greatly increased during the present generation. The love of art has become universal, and reproductions of all kinds are constantly appearing. The majority of literary works are illustrated, and the chief artistic achievements of the year in painting, sculpture, and decorative objects are known to the many through engraving, etching, and photography, and more or less mechanical reproduction in many different ways.

It has, therefore, become necessary that steps should be taken by the owners of such rights—whether as artists, collectors, engravers, publishers, or otherwise—to form a society for the protection from piracy of such rights, and for the consideration of matters of general interest connected with copyright.

The Artistic Copyright Society.—For these purposes the Artistic Copyright Society has been formed, the broad plan being that, as in this matter, the interests of artists, owners, and publishers are identical, the Society should be fully representative of every shade of interest concerned.

Several preliminary meetings have taken place, and support has been obtained of the most influential and representative character.

The President and Acting Vice-President of the Society have long devoted much time to copyright questions. The Honorary Vice-Presidents are gentlemen representing artists, collectors, lovers of art, experts in copyright, publishers, and others who are disposed to assist the objects of the Society. The Committee fully represents the working side of the members, and it will be recognised that the combination of artistic and commercial interests is adequate to the importance of the affairs involved.

The First Business.—As soon as its organisation is complete, the first serious business to which the Society will devote itself will be the endeavour to push through Parliament a Copyright Bill, such as will be acceptable to its members, and beneficial to the community at large.

The law of artistic copyright, especially from the time of the passing in 1862 of the Artistic Copyright Act (Paintings, Drawings, and Photographs), has been so very unsatisfactory that attempts to reform it have been constant ever since. It is a law that is full of ambiguity and of pitfalls for the unwary. Clearness and certainty are most important elements in the value of copyright to the artist, and to everyone interested in the sale, the production, and the publication of his work. Anything which renders the dealing with copyrights complicated and difficult lessens the value thereof to all parties concerned.

A year or two since a strong effort was made by the artists of this country, under the auspices of the Royal Academy, to simplify and amend the law; but the only result up to the present has been an inquiry before a Committee of the House of Lords, which has closed its sittings, and the matter appears once more to be shelved.

It is felt that the artistic copyright question ought not to be left where it now stands, but that fresh action should be taken by those interested joining forces, and thus becoming able to bring sufficient pressure to bear on Parliament to ensure the passing of a Bill making the necessary alterations in the law.

The success of the recent Act of Parliament controlling piracies of music emphasizes what is possible to be done for artistic copyright by united and persistent action.

The Rules of the Artistic Copyright Society.—The following are the resolutions adopted as the basis of the Society:—

(1) That the Society be called "The Artistic Copyright Society."

(2) That the Society is formed with the object of promoting the interests of all concerned in artistic copyright.

(3) That the attention of the Society shall be specially directed to the improvement, amendment, and codification of the laws relating to artistic copyright in the United Kingdom, and to the promotion of a Bill in Parliament to that end, and eventually to induce the Colonial Legislatures to bring their copyright laws into line with those of the United Kingdom.

(4) That a further object of the Society shall be to take such steps as may be deemed necessary or advisable to prevent piracy or infringement of artistic copyrights, and

(5) To give information on copyright questions to members of the Society.

(6) That painters, sculptors, architects, designers, engravers, owners of works of art, print publishers, print sellers, dealers in works of art, photographers, and all interested in the subject of artistic copyright shall be eligible for membership of the society.

(7) That election of members shall be vested in the Committee. Application for membership to be made to the Honorary Secretary in writing.

(8) That the annual subscription be £1 1s., payable on January 1st.

(9) That the officers of the Society be:—President, Acting Vice-President, Honorary Vice-Presidents, Chairman of Committee, Committee, Honorary Treasurer, Honorary Secretary, and Assistant Secretary.

Invitation to Become a Member.—In forwarding these statements to you, the Honorary Secretary is directed by the Committee to invite you to become a member, and to ask your support in the development of the Society. An early opportunity will be afforded of a General Meeting of the Society, to which, should you become a member, you will be invited.

Names and subscriptions (21s.) for 1903 should be sent to the Honorary Treasurer, C. Morland Agnew, The Old Bond Street Galleries, 39B, Old Bond Street, London, W.; or to the Honorary Secretary, D. C. Thomson, The Old Bond Street Galleries, 39B, Old Bond Street, London, W.

SCIENTIFIC AND OTHER SOCIETIES.*

British Association for the Advancement of Science.—This is an itinerant Association, corresponding to the British Pharmaceutical Conference. Headquarters: Burlington House, Piccadilly, W. Business is facilitated at the meetings by dividing the sciences into sections. This year's annual meeting will be at Southport. For further particulars address the Assistant-General Secretary.

British Pharmaceutical Conference.—Meets once a year, about the beginning of August, to promote the advancement of science and the improvement of pharmaceutical knowledge, as well as to foster good fellowship among its members. The membership is open to all persons interested in pharmacy. The annual subscription of 7s. 6d., payable July 1, entitles members to attend the annual meeting, and to receive a copy of the "Year-Book" annually. President for 1904, Mr. T. H. W. Idris, J.P., L.C.C.; Secretaries, Mr. E. Saville Peck, M.A. Cantab, and Mr. Edmund White, B.Sc., Lond. Address the Assistant Secretary, 17, Bloomsbury Square, London, W.C.

Chemical Society of London.—This is the parent Chemical Society of the world. A candidate for election as a Fellow must send to the secretaries a certificate stating his name, address, profession, and qualification. Under "qualifications" should be given a concise statement of the candidate's contributions to science, as investigator or author, or of his position and past experience as lecturer, teacher, assistant or student, or in connection with analytical or manufacturing chemistry. If the candidate's qualifications are not included under any of the above heads the reasons for his desiring admission to the Society must be stated. The certificate must be signed by five or more Fellows, of whom at least three must certify their recommendation from personal knowledge. Election is by ballot, after the certificate has been read at three meetings of the society. Every Fellow has the right to be present and to vote at all meetings of the Society, and to propose Candidates for admission, and is entitled to one copy of the publications issued, and to the use of the books in the library. Fellows also have the privilege of introducing two visitors at the ordinary meetings of the Society. Admission fee, £4; annual subscription, £2, due January 1; life composition fee, £30. Meetings are held on the first and third Thursdays, at 8 p.m., from November to June. An occasional meeting at 5 p.m. on Wednesdays is also held. Apply to the Assistant Secretary, Mr. Robert Steele, Burlington House, Piccadilly, London, W.

Dermatological Society, 11, Chandos Street, Cavendish Street, London, W.

General Medical Council.—This Council has power to deal with medical education and registration. Registrar for England, Mr. H. E. Allen, LL.B., B.A., 299, Oxford Street, London, W.

Geological Society, Burlington House, Piccadilly, London, W.—Address, the Secretary.

Income Tax Adjustment Agency.—The title explains the object of the Agency. Address 12 and 13, Poultry, London, E.C.

Institute of Chemistry.—The Fellowship of this Institute is obtained by examination. Students of the Institute pay an annual registration fee of 5s.; intermediate examination for Associateship, £5 5s.; final examination for Associateship, £5 5s.; special examination (open to Fellows and Associates), £2 2s.; entrance fee to the Fellowship, £5 5s.; annual subscription for Fellows and Associates, £1 1s.; life composition fee, £21. The F.I.C. certificate being recognised by the Local Government Board as evidence of qualification for appointment as public analyst, the Fellowship of the Institute is practically an essential for those desiring such appointments. Mr. David Howard is the President; Mr. Richard B. Pilcher, 30, Bloomsbury Square, W.C., the Secretary.

Linnean Society of London.—Candidates for the Fellowship must be proposed by three or more Fellows, who shall certify from personal knowledge his qualifications, Christian name, surname, rank, profession, and residence. Admission fee, £6; annual contribution, £3; composition fee, £45. Fees due May 24. Fellows are entitled to a copy of all publications of the society and to the use of the library. Fellows may introduce a friend to the ordinary meetings, which are held on most first and third Thursdays, from November to June, at 8 p.m. Address, Mr. B. D. Jackson, General Secretary, Linnean Society, Burlington House, Piccadilly, London, W.

Lister Institute of Preventive Medicine, Grosvenor Road, London, S.W., and Elstree, Herts, is a richly-endowed Institution, devoted mainly to bacteriological work and the preparation of pure animal medications—*e.g.*, various serums.

London Chamber of Commerce, Botolph House, Eastcheap, London, E.C.

London Commercial Sale Rooms, Limited, Mincing Lane, London, E.C. —Sales are held on certain Thursdays in the forenoon.

Pharmaceutical Society of Great Britain, 17, Bloomsbury Square, London, W.C.—Membership is restricted to persons who are duly registered as chemists and druggists. Annual subscription, £1 1s.; life membership, £10 10s. Student Associates pay an annual subscription of 10s. 6d.

Pharmaceutical Society of Ireland, 6, Lower Mount Street, Dublin. Membership is restricted to pharmaceutical chemists. Annual subscription, £1 1s. Associate druggists pay the same subscription.

Physical Society of London.—The headquarters are at Burlington House, Piccadilly, W. Meetings are held on Friday evenings in the rooms of the Chemical Society.

Röntgen Society, 20, Hanover Square, W. (Hon. Secretary, Mr. F. H. Low, M.B., 12, Sinclair Gardens, W.).—The objects of the Society are to discuss the Röntgen Rays in their relation to medicine, the arts and sciences; to exhibit apparatus and methods, to provide a museum, library, and Röntgen Ray appliances, and to publish transactions. Candidates for membership must have shown some scientific interest in the subject. Election is by ballot. Meetings are held monthly. Annual subscription, £1 1s.; life subscription, £15 15s.

Royal Agricultural Society, 13, Hanover Square, London, W.

Royal Botanic Society.—The gardens of this Society are in the inner circle, Regent's Park, London, N.W. Candidates for the Fellowship must be nominated by one Fellow, and are entitled to free admission to the gardens, which are tastefully laid out. The attractions include numerous palm houses, a house and garden of medicinal plants, a lake, a winter garden, museum, library, and lecture-room. There are numerous special shows of chrysanthemums and other flowers throughout the year, and during the London season a military band plays on the lawn on Wednesdays. Numerous attractive garden *fêtes* are held in the summer evenings. A club-house is provided for Fellows. Lectures are delivered on botanical subjects. Fellows pay an entrance fee of £5 5s. and an annual subscription of £2 2s., or one payment of £26 5s. for life. Members pay £1 10s. annually, or £15 15s. for life; no entrance fee. Fellows have the extra advantage of books of tickets admitting two friends to the gardens on all occasions, except on *fête* days

Royal College of Physicians, Pall Mall East, London, S.W.

Royal College of Surgeons, 39-43, Lincoln's Inn Fields.—The examination department of these two Colleges is on the Victoria Embankment, London, W. C. Address, the Secretary, Mr. F. G. Hallett.

Royal College of Veterinary Surgeons, Great College Street, Camden Town, London, N.W.

Royal Horticultural Society, 117, Victoria Street, London, S.W. (Rev. W. Wilks, M.A., Secretary).

Royal Institution of Great Britain, Albemarle Street, Piccadilly, W. (Assistant Secretary, Mr. Henry Young).—The chief objects of this Institution are to promote scientific and literary research, to teach the principles of inductive and experimental science, to exhibit the application of these principles to the arts, and to afford opportunities for study. The chemical and physical laboratories, which are magnificently equipped with apparatus, have been the birthplace of the principal researches of Thomas Young, Humphry Davy, Faraday, Tyndall, Frankland, Dewar, Rayleigh, and other eminent experimentalists. A prominent feature of the work of the Royal Institution is the various courses of lectures on all branches of science, literature, the fine arts, and music, as well as on subjects of general interest. These are held between Christmas and June. Candidates for admission must be proposed by four members; election is by ballot; the admission fee is ten guineas, and the annual subscription five guineas, or one payment of sixty guineas may be made on election. Members have the use of library, reading and writing rooms, and may admit friends to lectures under certain conditions. Non-members are admitted to all the courses of lectures in a session on payment of two guineas. Further particulars may be obtained from the Assistant Secretary.

Royal Meteorological Society, 70, Victoria Street, London, S.W.

Royal Microscopical Society, 20, Hanover Square, W. (Assistant Secretary, Mr. F. A. Parsons).—This Society was established for the promotion of microscopical and biological science. Ordinary Fellows are elected on a certificate of recommendation signed by three ordinary Fellows, setting forth the usual particulars as to name, residence, etc. Election is by ballot. Admission fee, £2 2s.; annual subscription, £2 2s.; composition fee, £31 10s. Meetings are held at 8 p.m. on the third Wednesday in each month from October to June. Visitors are admitted by the introduction of Fellows. The journal, containing the transactions of the Society and a summary of current researches relating to zoology, botany, microscopy, etc., is published bi-monthly, and is forwarded post free to Fellows. The library, with the instruments, apparatus and cabinet of objects, is open for the use of Fellows daily (except Saturdays) from 10 a.m. to 5 p.m.

Royal Society.—This Society, the pioneer of all the learned societies, stands on a somewhat different footing from all others, for the membership is regarded essentially and entirely as a recognition of special distinction in some branch of science, whereas in many societies the membership is simply a question of paying fees. The Fellowship of the Royal Society is an honour bestowed only on the leaders of science, and as such is much desired by scientific men. It is difficult of attainment. Candidates must be proposed and recommended by a certificate, stating the name, address, rank, profession, and qualification, and signed by six Fellows of the Society, three of whom must certify their personal knowledge of the candidate's fitness for the honour. The certificate must reach the Assistant Secretary (Mr. R. W. F. Harrison), Burlington House, Piccadilly, W., not later than the first Thursday in March. Election is by ballot; personal canvassing is not allowed. Fellows pay an entrance fee of £4, an annual subscription of £2, or a life composition fee of £30. Meetings are held at 4 p.m. on Thursdays from November to June.

Royal Society of Edinburgh.—Ordinary Fellows residing in Scotland pay an admission fee of two guineas and a yearly subscription of three guineas for ten years, and afterwards two guineas yearly for another fifteen years. Ordinary Fellows not resident in Scotland pay £26 5s. on admission. Ordinary Fellows receive the publications of the Society gratis. Candidates for admission as ordinary Fellows shall make an application in writing and produce a certificate of recommendation signed by at least four ordinary Fellows, two of whom shall certify their recommendation from personal knowledge. Election is by ballot. Meetings are held on the first and third Mondays of every month from November to March, with certain exceptions. The Society possesses a library and museum containing books, manuscripts, objects of natural history, scientific productions, etc.

Society of Apothecaries, London, Water Lane, Blackfriars, E.C. (Secretary, Mr. F. Haydon).—This society grants a diploma on examination, entitling the holder to be registered as a general medical practitioner.

Society of Arts, 18, John Street, Adelphi, London, W.C.—This society was formed for the purpose of advancing the useful arts and manufactures of this country, especially through the application of scientific and other researches to the development of commercial industries. The ordinary meetings are held on Wednesdays during the winter at 8 p.m. The society bestows upon individuals rewards for such productions, inventions, or improvements as tend to benefit the country, directly or indirectly. The Cantor Lectures form a prominent part of each winter's programme. Examinations are held annually at various centres, which are open to any person, the subjects including the principal divisions of a commercial education and music. A programme containing detailed information can be had on application to the secretary, Sir Henry Trueman Wood, M.A. The annual subscription to the society is two guineas, life subscription twenty guineas. The privileges of membership include admission to the lectures, exhibitions, conversazioni, library, and reading-room of the society. Candidates for the same are proposed by three members, one of whom at least must sign on personal knowledge, or are nominated by the council.

Society of Chemical Industry, Palace Chambers, 9, Bridge Street, Westminster, S.W. (General Secretary, Mr. Charles G. Cresswell).—The society was founded for the advancement of the study and practice of applied chemistry by discussion and by the diffusion of information on applied chemistry and chemical engineering among its members. Local sections have been formed at London, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, New York, as well as in Scotland (Glasgow and Edinburgh), in Yorkshire, and elsewhere. The monthly journal is of interest to manufacturers, works managers, inventors, and others as recording the latest advances in technical chemistry. Among others therein are sections on acids, alkalies, salts, electro-chemistry, fats, oils, and soap manufacture, resins and varnishes, manures, sugar, starch, gum, foods, disinfectants, fine chemicals, alkaloids, essences and extracts, photography, and analytical chemistry. London members meet in the

Chemcial Society's rooms, Burlington House, W. The society holds its annual meetings in July. Annual subscription, 25s.; entrance fee, one guinea. Members are tntitled to one monthly copy of the journal. Candidates for admission to the society must be formally proposed by at least one member to whom they are known personally.

Society of Public Analysts.—The membership of this society is open to persons who are engaged in the "profession of analytical chemistry," and is not restricted to public analysts holding their appointments under the Sale of Food and Drugs Acts. Election is by ballot, and a candidate must be recommended by not less than four members, of whom three at least must testify from personal knowledge to his "scientific and social fitness." The society mets in the rooms of the Chemical Society, Burlington House, Piccadilly, W., on the first Wednesday in each month from November to June. Annual subscription, £1 1s. Hon. secretary, Mr. E. J. Bevan, 4, New Court, Lincoln's Inn, W.C.

University of London, Imperial Institute, South Kensington, London, S.W.

Worshipful Company of Spectacle Makers, Guildhall, E.C. (Clerk, Colonel T. Davies Sewell, to whom all inquiries should be addressed).—The freedom of the company is open to members of the optical trade on passing certain theoretical and practical examinations. Further particulars will be found in the Photographic and Optical Supplement to the *Pharmaceutical Journal,* published March 28th last, as to examination fees, privileges, etc.

THE YORKSHIRE PHOTOGRAPHIC UNION.

Officers, 1902-1903.

President:—Mr. Percy Lund.

Vice-presidents:—Mr. Godfrey Bingley, Leeds; Dr. Hollingworth, Hull; Mr. J. H. Rowntree, Scarboro'; Dr. Paterson, Sheffield.

Hon. Treasurer:—Mr. Alex. Keighley, F.R.P.S.

Societies Comprising the Union:—Batley Photographic, Bradford Photographic, Brighouse Photographic, Cleveland Camera Club, Dewsbury Photographic, Halifax Camera Club, Harrogate Photographic, Heckmondwike Photographic, Holmfirth Photographic, Huddersfield Photographic, Hull Photographic, Ilkley Photographic, Keighley Photographic, Leeds Camera Club, Leeds Photographic, Pudsey Photographic, Rodley Photographic, Scarboro' Photographic, Sheffield Photographic, Skipton Photographic, Wakefield Photographic, Yeadon Photographic, York Photographic.

Hon. Business Secretary:—Mr. Ezra Clough, 10, Farncliffe Road, Manningham, Bradford.

Lantern Slide Section.—Hon. Sec.:—Mr. W. H. Houghton, King's Mill Lane, Huddersfield.

Print Portfolio Section.—Hon. Sec.:—Mr. W. H. Atkinson, Cemetery Lodge, Batley.

Jury of Selection.—Mr. Godfrey Bingley, Mr. Percy Lund, Mr. Alex Keighley, F.R.P.S., Mr. Percy Sheard.

Lectures, 1903.

Secretaries are requested to kindly note the following regulations:—

Invitations to lecture should be sent to the lecturers. Stamped envelopes should, in all cases, be enclosed for reply.

The expenses of each lecturer must be paid to him on the evening of the lecture, and it is expected that the society will provide hospitality, when the return journey is impossible, or inconvenient, on the same night.

Each lecture to be acknowledged in club syllabus as "Yorkshire Photographic Union Lecture."

There is no restriction on the number of lectures which a society may endeavour to secure from this list.

It is understood that the society making the engagement provides the lantern, if required, and that no charge to the public is made for any Union lecture. A reading lamp must always be provided for the use of the lecturer when a lantern is necessary.

Revisions and additions to this syllabus may be necessary from time to time—particulars may be obtained from the hon. secretary.

In addition to lectures, there will be two sets of lantern slides and two portfolios of prints issued by the Union for circulation, dates for which may be arranged with the hon. secretaries of the respective sections.

THE LONDON COUNTY COUNCIL'S CARBIDE OF CALCIUM REGULATION.

The following is an abstract of the Regulations as to the Keeping, Sale, and Conveyance of Carbide of Calcium in the County of London:—

This abstract has no legal validity, and is intended only for the information and guidance of the persons concerned. For further information reference should be made to the Petroleum Acts, and to the Orders in Council dated 20th February, 1897, *and 7th July*, 1897.

General.

1. By an order in Council, dated 26th February, 1897, carbide of calcium can only be kept in pursuance of a licence granted by the local authority.

2. By a further Order in Council, dated 7th July, 1897, not exceeding 5 lbs. of carbide may be kept without licence, provided it is kept in separate substantial hermetically-closed metal vessels containing not more than 1 lb. each.

Note.—The Order does not provide for the keeping of any quantity except in a closed vessel. Only one vessel should, therefore, be opened at a time, and the quantity of carbide, not exceeding 1 lb., required for use, should be at once placed in the generator, which should be immediately closed. If any carbide remain in the storage vessel, such vessel should be at once re-closed.

3. Where carbide of calcium is—
   (*a*) Kept at any place; or
   (*b*) Sold or exposed for sale,
   the vessel containing it shall bear a label stating in conspicuous characters, the words, 'Carbide of Calcium,' 'Dangerous if not kept dry,' and with the following caution:—'The contents of this package are liable if brought into contact with moisture to give off a highly inflammable gas,' and also the name and address of the owner or vendor.

Licences.

4. Application to the Council for a licence to keep carbide of calcium at any place in the County of London (except the City of London) must be made upon the form provided for the purpose, which can be obtained by application in writing, addressed to the Chief Officer, Public Control Department of the London County Council, 6, Waterloo-place, S.W.

5. Every application must be accompanied by a fee of 5*s.* in money, or, if sent through the post, by cheque or postal order for that amount payable to the order of the London County Council. The fee will be returned to the applicant if the licence be not granted.

6. Every application must state—
   (*a*) The quantity of carbide of calcium which the applicant desires to keep.

(*b*) The proposed place and method of storage;
(*c*) If the carbide is only to be kept for sale in closed vessels, or if it is to be used in the manufacture of acetylene gas.

7. Carbide of calcium should be kept in strong metal vessels, and—
(*a*) Such vessels should be so constructed and closed as to prevent the admission of water or atmospheric moisture.
(*b*) Such vessels should only be opened for the time necessary for the removal of any required quantity of carbide, or for the refilling of the vessels.
(*c*) No one vessel should have a greater capacity than 3696 cubic inches (equal to a cylindrical vessel, 14 inches in diameter and 24 inches in depth).
(*d*) Every vessel of a greater capacity than 2lbs. should be provided with a lock or be placed in a locked receptacle so as to prevent unauthorised persons gaining access to the contents.
(*e*) Copper should not be used in the construction of vessels for containing carbide.

8. Vessels containing carbide of calcium should not be kept inside dwelling-houses, but preferably in dry and well-ventilated outbuildings.

9. Small quantities of carbide for sale or immediate use will, however, be allowed in shops, dwelling or workshops, upon licensed premises, if the arrangements are satisfactory.

10. The Council proposes only to grant licences to keep carbide of calcium which is pure (in a commercial sense), *i.e.*, which contains no impurities liable to generate phosphoretted or siliciuretted hydrogen so as to render the gas evolved liable to ignite spontaneously.

11. Where carbide of calcium is kept for the manufacture of acetylene gas, it is desirable that such of the following precautions for ensuring safety as are applicable to the circumstances, should be adopted—
(*a*) Every apparatus for generating and storing acetylene gas should be placed in an outbuilding. (This does not apply to portable apparatus holding a charge of less than 2 lbs. of carbide).
(*b*) Such building should be separated as far as may be practicable from inhabited buildings, and should be well ventilated.
(*c*) No fire or such artificial light as would ignite inflammable gas should be taken into or near the building or place where a gas-making apparatus is situate.

12. Every apparatus (including generator and gas-holder) used for acetylene gas should as far as practicable be constructed and used so as to provide against the special risk, *i.e.*—
(*a*) Copper should not be used in any part of the apparatus.
(*b*) The various parts should be of adequate strength.
(*c*) Escape of gas from the apparatus should be carefully guarded against.
(*d*) Satisfactory provision should be made against dangerous development of heat.
(*c*) Satisfactory provision should be made against undue pressure by the employment of an adequate safety valve connected with a pipe discharging into the open air, and a suitable pressure gauge should be attached to the apparatus.
(*f*) Provision should be made for the residue of the carbide being mixed with at least ten times its bulk of water on being removed from the apparatus.
(*g*) No person should have charge of an apparatus until he has been properly instructed in its management.

13. Licences are granted for keeping carbide of calcium for periods not exceeding one year, and prior to expiration application must be made for

their renewal. Notice of the expiration, and a form of application for renewal, is sent to each licensee at the proper time.

Conveyance of Carbide of Calcium.

14. Where carbide of calcium is sent or conveyed, the vessel containing it shall bear a label stating in conspicuous characters the words, "Carbide of Calcium," "Dangerous if not kept dry," and with the following caution:—"The contents of this package are liable if brought into contact with moisture to give off a highly inflammable gas," and also the name and address of the sender.

15. Carbide of calcium conveyed to or from licensed premises must be conveyed in accordance with the conditions of the licence.

Inspection.

16. Any dealer who refuses to show to any officer authorised by the Council every or any place or all or any of the vessels in which carbide of calcium in his possession is kept, or to give him such assistance as he may require for examining the same, or to give to such officer samples of such carbide of calcium on payment of the value of such samples, or who wilfully obstructs the Council, or any officer of the Council, in the execution of these Acts and the order made thereunder, is liable to a penalty not exceeding twenty pounds. ALFRED SPENCER, *Chief Officer.*

6, *Waterloo-place, S.W., April* 21, 1899.

THE LONDON COUNTY COUNCIL'S NEW REGULATIONS RESPECTING THE USE OF CINEMATOGRAPH LANTERNS, &c., IN PREMISES LICENSED BY THE COUNCIL.

(Approved by the Council, October 16, 1900.)

1. No cinematograph, or other similar apparatus involving the use of a lengthy combustible film, shall be exhibited on premises licensed by the Council, until the Council has been satisfied that all reasonable precautions have been taken against accident and danger to the public.

2. Notice of any intended exhibition shall be given to the Clerk of the Council by the licensee of the premises in which such exhibition is to be given, and the licensee shall be held entirely responsible for the proper and safe use of the apparatus. Such notice shall be given at least three days before the first day of exhibition. Opportunity shall also be afforded to the Council's inspector of inspecting the apparatus before the public exhibition takes place, in order to allow time for any necessary alterations to be carried out and approved by the Council. No gangway or exit must be in any way affected.

3. The cinematograph shall stand in a suitable fire-proof room or closed sheet-iron box of sufficient dimensions to allow the operators to work freely and fitting closely to the floor, which shall be covered with fire-resisting material within such room or box. The door or doors shall open outwards and be self-closing, and of the three windows which are necessary in the front face of the enclosure, the centre one shall not exceed 8 inches square, and the windows on each side shall not exceed 6 inches square; a flap screen, to cover all these three holes, shall be fitted and actuated both from the inside and from the outside of the enclosure; the space separating the audience and seats from the iron enclosure shall not be less than 2 feet in width at the sides and in the front of the enclosure, and the space at the back in which the door is situated shall not be less than 6 feet from the enclosure. The audience shall be completely excluded from the above space around the enclosure by a suitable barrier. No unnecessary combustible material shall be within the enclosure, and, as far as possible, all necessary combustible material shall be rendered fire-proof, or shall be

enclosed in fire-proof receptacles. The part of the film immediately opposite the lens shal be provided with an apparatus which prevents the film, if kindled, from burning towards either of the spools.

4. The body of the lantern shall be constructed of wood or other non-conducting material, and shall be coated inside with asbestos; it shall also have an inner lining of sheet-iron, and an air space shall be left between the iron and asbestos lining. In the bottom of the lantern shall stand an iron tray, which shall be surrounded by a vertical edge at least 1 inch in depth. The lantern shall be provided with a metal shutter, which shall fall freely between the source of light and the condenser. This shutter shall be immediately dropped in the event of any accident to the apparatus or stoppage of the film, and shall only be raised when the film is in motion for the purpose of projection.

5. Where possible the electric arc light shall be adopted as an illuminant, the usual rules for securing safety in an electric installation being observed. Ether and other inflammable liquids shall not be employed under any circumstances for producing light. If limelight be used in the lantern the general regulations for its safety, which are issued by the Council, shall be complied with, and any additional precautions which the Council may deem necessary for securing safety shall also be adopted. The use of acetylene gas will not be permitted.

6. The space in which the cinematograph stands shall, where possible, be illuminated by electric glow lamps; but a miner's safety lamp may be substituted, if necessary. No naked gas or oil flames, or matches shall be allowed in the space. The lighting of the hydrogen flame in the lantern shall be accomplished by means of an electric lighter.

7. The films, when not actually passing through the lantern, shall be kept enclosed in metal cases. The film which is passing through the lantern shall be re-wound, either automatically or by hand, upon another bobbin as fast as it emerges from the lantern front.

8. Not less than two, nor more than three, operators shall be engaged within the lantern space, and no other persons shall be within the lantern enclosure during the exhibition. The whole duty of one of the operators shall consist in taking charge of the film after it has passed through the lantern.

9. The licensee shall be held responsible for the employment of competent, experienced and trustworthy operators, and shall be prepared at any time to supply to the Council satisfactory credentials in this respect.

10. Smoking within the lantern space shall be absolutely forbiden at all times.

11. The Council reserves to itself the right of modifying any of the above regulations and of requiring the adoption of any further precautions, in addition to those specified above, as circumstances may require.

THE POISONS ACT.

The following is a list of poisons scheduled in the Poisons Act.

Schedule A.

Part 1.—Arsenic and its preparations, prussic acid, cyanide of potassium and all metallic cyanides, strychnine and all poisonous vegetable alkaloids and their salts, aconite and its preparations, emetic tartar, corrosive sublimate, cantharides, savin and its oil, ergot of rye and its preparations.

Part 2. Oxalic acid, chloroform, belladonna and its preparations, essential oil of almonds unless deprived of its prussic acid, opium and all preparations of opium or of poppies.

The clauses of the Act which relate to the sale of poisons by unqualified persons are two in number, and are as follows:—

From and after December 31, 1868, any person who shall sell or keep an open shop for the retailing, dispensing, or compounding poisons, or who shall take, use, or exhibit the name or title of chemist and druggist, or chemist or druggist, not being a duly registered pharmaceutical chemist, or chemist and druggist, or who shall take, use, or exhibit the name or title pharmaceutical chemist, pharmaceutist, or pharmacist, not being a pharmaceutical chemist, or shall fail to conform with any regulation as to the keeping or selling of poisons made in pursuance of this Act, or who shall compound any medicines of the British Pharmacopœa, except according to the formularies of the said pharmacopœa, shall for every such offence be liable to pay a penalty or sum of 5*l.*, and the same may be sued for, recovered, and dealt with in the manner provided by the Pharmacy Act for the recovery of penalties under the Act; but nothing in this Act contained shall prevent any person from being liable to any other penalty, damages, or punishment to which he would have been subject if this Act had not passed.

It shall be unlawful to sell any poison, either by wholesale or by retail, unless the box, bottle, vessel, wrapper, or cover in which such poison is contained be distinctly labelled with the name of the article and the word poison, and with the name and address of the seller of the poison; and it shall be unlawful to sell any poison of those which are in the first part of Schedule A to this Act, or may hereafter be added thereto under section two of this Act, to any person unknown to the seller, unless introduced by some person known to the seller; and on every sale of any such article the seller shall, before delivery, make or cause to be made, an entry in a book to be kept for that purpose stating, in the form set forth in Schedule F to this Act, the date of the sale, the name and address of the purchaser, the name and quantity of the article sold, and the purpose for which it is stated by the purchaser to be required, to which entry the signature of the purchaser and of the person, if any, who introduced him shall be affixed; and any person selling poison otherwise than is herein provided shall, upon a summary conviction before two justices of the peace in England, or the sheriff in Scotland, be liable to a penalty not exceeding 5*l.* for the first offence, and to a penalty not exceeding 10*l.* for the second or any subsequent offence, and for the purpose of this section the person on whose behalf any sale is made by any apprentice or servant shall be deemed to be the seller; but the provisions of this section, which are solely applicable to poisons in the first part of the Schedule A to this Act, or which require that the label shall contain the name and address of the seller, shall not apply to articles to be exported from Great Britain by wholesale dealers, nor to sales by wholesale to retail dealers in the ordinary course of wholesale dealing, nor shall any of the provisions of this section apply to any medicine supplied by a legally qualified apothecary to his patient, nor apply to any article when forming part of the ingredients of any medicine dispensed by a person registered under this Act; provided such medicine be labelled, in the manner aforesaid, with the name and address of the seller, and the ingredients thereof be entered, with the name of the person to whom it is sold or delivered, in a book to be kept by the seller for that purpose; and nothing in this Act contained shall repeal or affect any of the provisions of an Act of the Session holden in the fourteenth and fifteenth years in the reign of Her present Majesty, intituled *An Act to Regulate the Sale of Arsenic.*

A TABLE OF POISONS AND ANTIDOTES. Compiled by Mr. J. V. ELSDEN

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid.	OXALIC ACID, including POTASSIUM OXALATE	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies.	AMMONIA POTASH SODA	Vapour of ammonia may cause inflammation of the lungs.	Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts.	MERCURIC CHLORIDE	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yoke of raw eggs with milk. In emergency, flour paste may be used.
	ACETATE OF LEAD	The sub-acetate is still more poisonous.	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia Emetic of sulphate of zinc.
	CYANIDE OF POTASSIUM	*a.* Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	BICHROMATE OF POTASSIUM	*a.* Taken internally.	Irritant pain in stomach and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	NITRATE OF SILVER		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	NITRIC ACID	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe, and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	HYDROCHLORIC ACID	½ ounce has caused death.		
	SULPHURIC ACID	1 drachm has been fatal.		
	ACETIC ACID, concentrated, has as powerful an effect as the mineral acids.			
	IODINE	Variable in its action; 3 grains have been fatal	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged, and gruel, arrowroot, and starch given freely.
	ETHER	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	PYROGALLOL	2 grains sufficient to kill a dog	Resembles phosphorous poisoning	No certain remedy. Speedy emetic desirable.

INSURANCE COMPANIES AND EXHIBITIONS OF ANIMATED PHOTOGRAPHY

In view of the increasing number of Exhibitions of animated pictures which are being held, it may be desirable that our readers should know under what conditions Fire Offices allow the use (either temporary or permanent) of cinematographs or similar apparatus. The following have been adopted by Insurance Companies:—

Rules *re* Exhibition of Animated Pictures.

1. The lantern must be constructed of metal or lined with metal and asbestos.

2. An alum or water bath must be used between the condenser and the film.

3. The apparatus must be fitted with a drop shutter available in case of emergency.

4. If the film does not wind upon a reel or spool immediately after passing through the machine, a metal receptacle with a slot in the metal lid must be provided for receiving it.

5 If electric arc lights are used, the installation must be in accordance with the usual rules, *i.e.*, the choking coils and switch to be securely fixed on incombustible basis, preferably on a brick wall, and d.p. safety fuses to be fitted.

6. If oxyhydrogen gas is used, storage must be in metal cylinders only.

7. The use of an ether saturator is not to be permitted under any circumstances.

Position.—Preferably on an open floor with a space of at least six feet all round railed off. If in a compartment, the compartment to be lined with fire-resisting materials. In any case no drapery or combustible hangings to be within two yards.

General.—Fire buckets to be kept filled, and a damp blanket to be provided and placed close at hand.

FREEZING MIXTURES.

The following mixtures will be found useful where ice is not readily obtainable—

	Ingredients.	Parts by Weight.	The Temperature at starting being 50° Fahr. the thermometer sinks.	Diminution of Temperature.
1	Water Nitrate of ammonia	1 1	From +50° to + 4°	46° Fahr.
2	Water Saltpetre Chloride of ammonuim (sal ammoniac)	16 5 5	,, +50° ,, +10°	40° ,,
3	Water Nitrate of ammonia Carbonate of soda	1 1 1	,, +50° ,, + 7°	43° ,,
4	Snow Chloride of sodium	2 1	,, 32° ,, − 5°	37° ,,
5	Snow Crystallised chloride of calcium	2 3	,, +32° ,, −50°	82° ,,
6	Crystallised sulphate of soda Hydrochloric acid	8 5	,, + 0° ,, 0°	50° ,,

COINS AS WEIGHTS AND MEASURES.

1 Sovereign weighs	123·274 grains
1 Shilling ,,	87·273 ,,
48 Pence ,,	1 lb. avoirdupois
Half-penny and three-penny piece weigh	$\frac{1}{4}$ ounce
Florin and sixpence	$\frac{1}{2}$,,
Three pennies	1 ,,
4 half-crowns and 1 shilling	2 ounces
4 florins, 4 half-crowns, 2 pennies, weigh	4 ,,

1 half-penny = 1 inch in diameter

ENGLISH AND METRICAL SIZES OF PLATES.

English Sizes Converted into Metric Measure.

Inches.				Centimetres.		
$3\frac{1}{4}$	×	$3\frac{1}{4}$	(Lantern size)	8·2	×	8·2
$4\frac{1}{4}$	×	$3\frac{1}{4}$	(Quarter-plate)	10·8	×	8·2
5	×	5	(American size)	12·7	×	10·1
$6\frac{3}{4}$	×	$3\frac{1}{4}$	(Stereoscopic)	17·2	×	8·2
$6\frac{1}{2}$	×	$4\frac{1}{4}$	(Double quarter)	16·5	×	10·8
$6\frac{1}{2}$	×	$4\frac{3}{4}$	(Half-plate)	16·5	×	12·0
7	×	5		17·7	×	12·7
$7\frac{1}{2}$	×	5		19·0	×	12·7
8	×	5		20·3	×	12·7
$8\frac{1}{2}$	×	$6\frac{1}{2}$	(whole-plate)	21·5	×	16·5
9	×	7		23·0	×	17·7
10	×	8		25·4	×	20·3
12	×	10		30·5	×	25·4
15	×	12		38·0	×	30·5
18	×	16		46·0	×	40·6
20	×	16		50·8	×	40·6
22	×	18		55·9	×	46·0
24	×	20		61·0	×	50·8

Metrical Sizes Converted into English Measures.

Centimetres.			Inches.		
9	×	12	$3\frac{9}{16}$	×	$4\frac{3}{4}$
12	×	15	$4\frac{11}{16}$	×	$5\frac{7}{8}$
13	×	18	$5\frac{1}{8}$	×	$7\frac{1}{8}$
18	×	24	$7\frac{1}{8}$	×	$9\frac{1}{2}$
21	×	27	$8\frac{5}{16}$	×	$10\frac{11}{16}$
24	×	30	$9\frac{1}{2}$	×	$11\frac{7}{8}$
30	×	40	$11\frac{7}{8}$	×	$15\frac{3}{4}$
40	×	50	$15\frac{11}{16}$	×	$19\frac{11}{16}$

EXHIBITION RULES.

The following rules for the conduct of Photographic Exhibitions have been agreed to by a conference of Judges:—

Rules.

1. The Judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.
2. The Judges shall have full power to withhold any award, and this shall be stated in the prospectus.

3. The Judges shall have power to exclude all persons from the room while udging.

4. The Judges' expenses shall be paid.

5. The Judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.

6. No awards shall take the form of a money prize.

7. Where there is a champion class, pictures which have previously taken awards in OPEN classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide or other form ; but in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

9. There shall be no distinction between amateur and professional.

10. No production of any kind whatever from the same negative shall receive more than one award, at the same exhibition. This includes lantern slides, enlargements, &c.

11. No award shall be made to a lantern slide until it has been projected on the screen.

12. It shall be stated on the entry form to what extent the work sent for competition is that of the exhibitor.

13. That the names of those who have consented to act as Judges shall be printed in the prospectus of the Exhibition.

RECOMMENDATIONS.

14. Where the Judges make more than one award to the same competitor all these should be published in the award list, although there be an exhibition regulation debarring a competitor from receiving more than one prize.

15. The Judges should have power to give extra awards where they may think fit.

16. In order to enhance the value of awards their number should be limited.

17. The Exhibition Committee should not accept offers of awards from trading firms.

18 It is desirable not to have classes. Where there are classes, their number should be kept as small as possible, and divisions where made should be entirely respecting "subjects," such as portraiture, landscape, &c., and not such as hand-camera classes, enlargement classes, &c.

The undermentioned Judges have signified their intention of upholding the rules of all future open exhibitions :—

R. CHILD BAYLEY,
THOMAS BEDDING,
J. BULBECK,
HAROLD BAKER,
F. P. CEMBRANO,
LYONEL CLARK,
WALTER L. COLLS,
P. H. EMERSON,
J. GALE,
JOHN H. GEAR,
J. P. GIBSON,
JOHN A. HODGES,
FREDERICK HOLLYER,
PAYNE JENNINGS,
FRED. C. LAMBERT,

PAUL LANGE,
EDGAR G. LEE,
PERCY LUND,
A. MACKIE,
C. H. OAKDEN,
ANDREW PRINGLE,
JAMES A. SINCLAIR,
HENRY STURMEY,
W. THOMAS,
W. WAINWRIGHT,
E. J. WALL,
H. SNOWDEN WARD,
MRS. CATHARINE WEED WARD
J. B. B. WELLINGTON.

ON THE RELATIVE POWER OF LANTERN ILLUMINANTS.

M. Molteni gives these as follows. His experiments were made with an ordinary lantern, in the stage of which was inserted a screen with an opening seven cm. square, similar to the marks used in mounting lantern transparencies. The distance of the lantern from the screen was so adjusted that the side of the enlarged image of the square measured one metre. The enlarged image was received on the Bunsen grease spot (commonly used in photometry), the surface of which, remote from the lantern, was illuminated by a lamp carefully standardised by means of a "Carcel" standard, burning forty-two grammes of oil per hour. The "Carcel" lamp is the standard of light in general use in France. It is equal to ten English standard sperm candles. The distance of the standard lamp from the screen was adjusted so as to obtain equality of illumination on each side, and the relative intensity of the various lights was calculated from the distances thus obtained. It will, of course, be understood that during the various trials the lantern was not moved from the position necessary to give an enlargement of one metre square. The following are the results obtained :—

Multiple wick oil lamps	1
Welsbach burner (No. 2) without reflector	1
ACETYLENE—	
1 burner, without reflector	1·06
2 burners, without reflectors	1·70
3 ,, ,, ,,	3·20
4 ,, ,, ,,	4·10
5 ,, ,, ,,	4·50
LIMELIGHT—	
Oxycalcium (alcohol and oxygen)	5·80
Oxyhydrogen (coal gas and oxygen)	16·60
Oxyether (gasoline and oxygen)	18·50
ELECTRIC (CONTINUOUS CURRENT)—	
Ordinary incandescent lamp 32 c.p. (?)	·68
,, ,, (vertical) 50 c.p. (?)	·93
,, ,, (horizontal) 50 c.p. (?)	·93
Focus lamp, 100 c.p.	3·82
Arc Lamp, 7 ampères	39·03
,, 10 ,,	75·61
,, 12 ,,	86·50
,, 15 ,,	117·61
,, 20 ,,	160·80

The above results might, of course, have been expressed in terms of the Carcel unit, but the author is of the opinion that the table is likely to be more useful in the form in which an ordinary multiple wick oil lamp is taken as an approximate unit, since every one who has had the mere experience in lantern matters will be able to attach a tangible value to the figures when thus expressed; as, for instance, that the oxyhydrogen light is from sixteen to eighteen times more powerful than the paraffin lamp or an arc light of seven ampères about twice the power of the oxyhydrogen light.

TABLE FOR FINDING THE MINIMUM LENGTH OF STUDIO FOR A GIVEN LENS.

(From the "American Amateur Photographer.")

DISTANCES IN INCHES FROM OBJECT TO LENS.

Equivalent Focus of Lens. In.	3 in. high.	4 in. high.	5 in. high.	6 in. high.	8 in. high.	10 in. high.	12 in. high.	16 in. high.	20 in. high.	24 in. high.	30 in. high.	36 in. high.	48 in. high.	54 in. high.	60 in. high.	72 in. high.
3	75	57														
4	100	76	$61\frac{3}{5}$	52												
5	125	95	77	65	50											
6	150	114	$92\frac{3}{5}$	78	60	$49\frac{1}{8}$										
8	200	152	$123\frac{1}{5}$	104	80	$65\frac{6}{10}$	56									
10	250	190	154	130	100	82	70	55								
12	300	228	$184\frac{4}{5}$	156	120	$98\frac{3}{5}$	84	66	$55\frac{1}{5}$							
16	400	304	$246\frac{2}{5}$	208	161	$131\frac{1}{5}$	112	88	$72\frac{2}{5}$	64	$54\frac{2}{5}$	48				
20	500	380	308	260	200	164	140	110	$90\frac{3}{4}$	80	68	60	50	$46\frac{2}{3}$		
24	600	456	$369\frac{3}{5}$	312	240	$196\frac{4}{5}$	168	132	$110\frac{2}{5}$	96	$81\frac{3}{5}$	72	60	56	$52\frac{4}{5}$	48
30	750	540	462	390	300	246	210	165	$136\frac{1}{8}$	120	102	90	75	70	65	60
36	900	684	$554\frac{2}{5}$	463	360	$307\frac{1}{5}$	252	198	$165\frac{3}{5}$	144	$122\frac{2}{5}$	108	90	84	$79\frac{1}{5}$	72
48	1200	912	$739\frac{1}{5}$	624	480	$393\frac{1}{5}$	336	264	$220\frac{4}{5}$	192	$163\frac{1}{5}$	144	120	112	$105\frac{3}{5}$	96
60	1500	1080	1024	780	600	492	420	330	$272\frac{1}{4}$	240	204	180	150	140	132	120
72	1800	1368	$1108\frac{4}{5}$	936	720	$614\frac{2}{5}$	504	396	$321\frac{1}{5}$	288	$244\frac{4}{5}$	216	180	168	$158\frac{3}{5}$	144

DISTANCES IN INCHES FROM LENS TO GROUND GLASS.

Equivalent Focus of Lens. In.	3 in. high.	4 in. high.	5 in. high.	6 in. high.	8 in. high.	10 in. high.	12 in. high.	16 in. high.	20 in. high.	24 in. high.	30 in. high.	36 in. high.	48 in. high.	54 in. high.	60 in. high.	72 in. high.
3	$3\frac{1}{8}$	$3\frac{1}{6}$														
4	$4\frac{1}{6}$	$4\frac{2}{9}$	$4\frac{5}{18}$	$4\frac{1}{3}$												
5	$5\frac{5}{24}$	$5\frac{5}{18}$	$5\frac{25}{72}$	$5\frac{5}{12}$	$5\frac{5}{9}$											
6	$6\frac{1}{6}$	$6\frac{1}{3}$	$6\frac{5}{12}$	$6\frac{1}{2}$	$6\frac{2}{3}$	$7\frac{1}{9}$										
8	$8\frac{1}{3}$	$8\frac{4}{9}$	$8\frac{5}{9}$	$8\frac{2}{3}$	$8\frac{8}{9}$	$9\frac{1}{9}$	$9\frac{1}{3}$									
10	$10\frac{5}{12}$	$10\frac{5}{9}$	$10\frac{25}{36}$	$10\frac{5}{6}$	$11\frac{1}{9}$	$11\frac{7}{18}$	$11\frac{1}{2}$	$12\frac{2}{9}$								
12	$12\frac{1}{2}$	$12\frac{2}{3}$	$12\frac{5}{6}$	13	$13\frac{1}{3}$	$13\frac{2}{3}$	14	$14\frac{2}{3}$	$15\frac{1}{3}$							
16	$16\frac{2}{3}$	$16\frac{8}{9}$	$17\frac{1}{9}$	$17\frac{1}{3}$	$17\frac{7}{9}$	$18\frac{2}{9}$	$18\frac{2}{3}$	$19\frac{5}{9}$	$20\frac{1}{6}$	$21\frac{1}{3}$	$22\frac{2}{3}$	24				
20	$20\frac{5}{6}$	$21\frac{1}{9}$	$21\frac{7}{18}$	$21\frac{2}{3}$	$22\frac{2}{9}$	$22\frac{7}{9}$	$23\frac{1}{3}$	$24\frac{4}{9}$	$25\frac{5}{24}$	$26\frac{2}{3}$	$28\frac{1}{3}$	30	$33\frac{1}{3}$	35		
24	25	$25\frac{1}{3}$	$25\frac{2}{3}$	26	$26\frac{2}{3}$	$26\frac{5}{9}$	28	$29\frac{1}{3}$	$30\frac{2}{3}$	32	34	36	40	42	44	48
30	$31\frac{1}{4}$	$31\frac{2}{3}$	$32\frac{1}{12}$	$32\frac{1}{2}$	$33\frac{1}{3}$	$34\frac{1}{6}$	35	$36\frac{2}{3}$	$38\frac{1}{3}$	40	$42\frac{1}{2}$	45	50	$52\frac{1}{2}$	55	60
36	$37\frac{1}{2}$	38	$38\frac{1}{2}$	39	$39\frac{2}{3}$	40	42	44	46	48	51	54	60	63	66	72
48	50	$50\frac{2}{3}$	$51\frac{1}{3}$	52	$53\frac{1}{3}$	$54\frac{2}{3}$	56	$58\frac{2}{3}$	$61\frac{1}{3}$	64	68	72	80	84	88	96
60	$62\frac{1}{2}$	$63\frac{1}{3}$	$64\frac{1}{6}$	65	$66\frac{2}{3}$	$68\frac{1}{3}$	70	$73\frac{1}{3}$	$77\frac{2}{3}$	80	85	90	100	105	110	120
72	75	76	77	78	$79\frac{1}{3}$	80	84	88	92	96	102	108	120	126	132	144

Suppose the lens used is 24 in. equivalent focus, and you wish to make a full-length portrait of a man 6 ft. high, in which the image will be 6 in. high. Look at the left-hand column for lens focus, and in the top line for size of image. At the intersection of these columns we find 312 in. = 26 ft., to be the distance the person must stand from the lens. In the next table, using the same lens and size of image as before, at the intersection of the columns we find 26 in., which represents the distance of the ground glass from lens centre And in the same way any lens and size of image may be computed for.

CHARACTERISTIC REACTIONS OF THE KNOWN DEVELOPING AGENTS.

[Translated from the *Photographische Correspondenz.*]

By Dr. M. Andresen.

The number of the developing substances used in photography has so considerably increased in the last decade that a summary of the characteristic reactions of these substances will be useful to the practical worker. The tabular statement will render it easy for any expert to recognise any developer which may be introduced into the market under a fancy name.

It is advisable to make the investigation in a systematic manner. The substances must be tested in a given order of reatcions, so that it will be easier and more certain to determine what developing substances may be present, and then to determine by special tests what is the actual substance.

The procedure is somewhat different, according to whether the substance is in the solid or liquid form.

A. The Substance is a Solid.

A small quantity, about 1 gramme, should be finely powdered and dissolved in 100 c.c. of cold water.

(*a*) The substance will not dissolve. Test for glycin and di-amido-oxyphenol.

1. It dissolves on the addition of some solid sodium sulphite and carbonate of potash = glycin. Test the solubility of the original substance in water on the addition of hydrochloric acid (soluble) and of acetic acid (insoluble), and whether the solution, acidulated with dilute sulphuric acid, gives off the smell of quinone on oxidation with potassium bichromate (1 : 15).

2. The substance does not dissolve on addition of sodium sulphite and potash = di-amido-oxyphenol. The original substance should be soluble in water in the presence of acetic acid, so that no quinone is formed on oxidation.

(*b*) A clear solution is formed. In this case all the other developing agents must be tested for.

Add to the one per cent. aqueous solution five per cent. of dry sodium sulphite and ten per cent. of potassium carbonate.

1. If a fine crystalline powder separates out = para-amidophenol. This should be confirmed by the special reactions.

2. The solution remains clear, but becomes coloured; it may be amidol, eikonogen, tri-amidophenol, pyrogallol, or di-amido-resorcin.

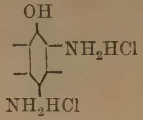
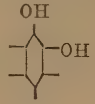
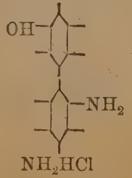
(*a*) If the colour is blue = amidol. Test further.

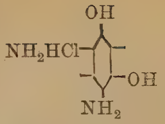
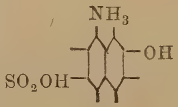
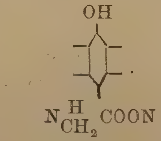
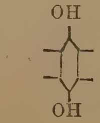
(*b*) The colour is golden yellow, and does not alter on standing exposed to the air = eikonogen. Test further.

(*c*) Colour greenish, especially when shaken in a half-filled bottle, and turns brown on adding a few drops of caustic soda = tri-amidophenol. Test further with ferric chloride.

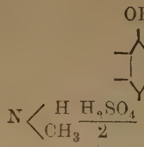
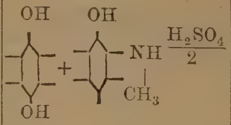
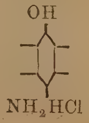
(*d*) The solution is brown, which increases on shaking in the air = pyrogallol or di-amido-resorcin. Add a few drops of caustic soda.

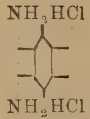
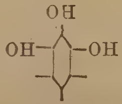
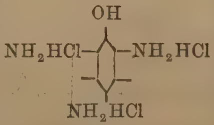
REACTIONS OF DEVELOPING SUBSTANCES.

COMMERCIAL NAME.	SCIENTIFIC NAME.	CONSTITUTION FORMULA.	CRYSTALLINE FORM.	MELTING POINT OF THE COMPOUND.	SOLUBILITY.	BEHAVIOUR TO ACIDS.
AMIDOL.	Hydrochlorate of 2·4 di-amidophenol.		Colourless needles.	Decomposes on heating without melting.	Easily soluble in water. Sol. in alcohol and ether with difficulty.	Precipitated from aqueous solution by conc. hydrochloric acid.
BRENZCATECHINE or PYROCATECHINE.	1·2 Dioxybenzol.		Broad flakes (from benzol). Prismatic needles (from water).	104°	Readily soluble in water, alcohol, and ether; soluble in cold benzol.	——
DI-AMIDO-OXYDI-PHENAL or DIPHENAL.	Di-amido-oxyphenol.		From water in long felted needles.	148°	Readily soluble in alcohol, glacial acetic acid, and hot water; with difficulty in benzol; almost insoluble in cold water.	Soluble in dilute acids; for instance, acetic.

DI-AMIDO-RESORCIN.	Hydrochlorate of 4·6 Di-amido-resorcin.		Rhombic tables.	Decomposed by heat without melting.	Very soluble in water; sol. with difficulty in alcohol and ether.	Very readily ppt. by conc. HCl from aqueous sol.
EIKONOGEN.	Sodium salt of α_1 amido-β_1-naphthol-β_3-sulphonic acid.		Rhombic plates.	Loses at 110° $2\frac{1}{2}$ molecules of water of crystallisation. On further heating, decomposes without melting.	Easily soluble in hot water; less soluble in cold; almost insoluble in alcohol and ether.	Acids precipitate the free acid in fine white needles from aqueous solution of eikonogen.
GLYCIN.	p-oxyphenyl-glycin.		Mica-like plates.	Melts with decomposition.	V. s. sol. in water and alcohol, insol in ether.	Forms with mineral acids salts sol. in water, but not with acetic acid.
HYDROQUINONE.	1·4 dioxy-benzol.		Needles, or long hexagonal plates.	169°	Easily sol. in alcohol, ether, and hot water, less sol. in cold, sol. in cold benzol.	——

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME.	SCIENTIFIC NAME.	CONSTITUTION FORMULA.	CRYSTALLINE FORM.	MELTING POINT OF THE COMPOUND.	SOLUBILITY.	BEHAVIOUR TO ACIDS.
METOL.	Sulphate of the methyl, p. amidophenol.		Needles or prisms. The free base crystallises in long needles.	Decomposes without melting. The free base melts at 87° C.	V. sol. in water, s. sol. alcohol and ether. The free base v. sol. in alc., ether, and hot water, less sol. in cold.	—
ORTOL.	Sulphate of methyl-o-amidophenol + hydroquinone (a mixture).		Sulphate of methyl of amidophenol crystallises in flat rhombic tables or prisms.	Sulphate of methyl of amidophenol decomposes on heating without melting. The free base melts at 80° with decomposition.	V. sol. in water, partial sol. in alcohol and ether (hydroquinone dissolves).	—
PARA-AMIDO-PHENOL.	Hydrochlorate of 1·4 amido-phenol.		Prisms. The free base crystallises in plates.	Decomposed on heating without melting. The free base melts with decomposition at 184°.	V. sol. in water, s. sol. in alcohol and ether. The free base is v. sol. in hot, s. sol. in cold water, fairly sol. in alcohol, s. sol. in ether.	Precipitated from aqueous sol. by conc. hydrochloric acid.

PARA-PHENYL-ENDIAMINE.	Hydrochlorate of 1·4 phenyl-diamine.		Tricilinic tablets The free base crystallises from ether in tablets. From water monoclinic crystals are obtained which are converted in the water into rhombic plates.	Decomposed without melting. The free base melts at 140°.	V. sol. in water. S. sol. in alcohol. M. sol. in ether. The free base is v. sol. in alcohol and ether, less sol. in water.	Ppt. by conc. hydrochloric acid from the aqueous solution.
PYROGALLOL.	1·2 3-Tri-oxy-benzol.		Colourless shining needles.	Melts at 132·5°.	V. sol. in water, alcohol, and ether.	——
TRI-AMIDO-PHENOL.	Hydrochlorate of 2·4·6 tri-amidophenol.		Needles.	Decomposed without melting.	V. sol. in water, almost insol. in alcohol and ether.	Conc. hydrochloric acid ppt. the compound from aqueous solution.

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME.	BEHAVIOUR TO ALKALIES	BEHAVIOUR TO OXIDISING SUBSTANCES.	USED AS A DEVELOPER IN CONJUNCTION WITH—	REMARKS.
AMIDOL.	Sulphite solutions on addition of potassium carbonate turn blue, with caustic potash a Bordeaux red colour.	Ferric chloride produces an intense red colour in aqueous solution. Amidol does not give quinone on oxidation.	Neutral sodium sulphite; alkalies.	—
BRENZCATECHINE or PYROCATECHINE.	Cannot be separated from an aqueous sol. by shaking with ether in the presence of caustic alkalies After acidulation of the sol is taken up by the ether.	An aqueous solution gives an emerald green colour with a drop of ferric chloride; without the addition of carb. soda, turns violet red. Gives no quinone.	Alkaline carbonates.	Solution of lead acetate causes a white ppt. with aqueous solution of pyrocatechine.
DI-AMIDO-OXYDI-PHENAL or DIPHENAL.	Not soluble with sulphite or alkaline carbonates, requires caustic alkalies.	Gives no quinone on oxidation.	Caustic alkalies.	The diazo compound of di-amido-oxyphenol gives, with Andresen's *a*-naphthol-disulphonic acid a ponceau red dye (compare para-amidophenol).

DI-AMIDO-RESORCIN.	Aqueous sulphite sol. give with pot. carb. a yellow brown; with caustic alkalies, a blue colour.	One drop of ferric chloride sol. gives, in dilute di-amido-resorcin sol., an intense violet colour, which after a short time disappears. No quinone formed.	Neutral, alkaline, sulphites.	—
EIKONOGEN.	Alkaline solutions have a golden yellow colour.	No quinone on oxidation.	Neutral sulphites with alkaline carbonates.	—
GLYCIN.	Is converted by sodium sulphite, carbonate, and caustic alkalies into salts, which are readily soluble in water.	Gives chinone when oxidised with pot. bichrom. and sulphuric acid, with evolution of CO_2.	Caustic alkalies and carbonates.	—
HYDROQUINONE.	Not separated from alkaline aqueous sol. by agitation with ether; is removed, however, after acidifying.	Is easily converted by oxidising agents into quinone. A convenient oxidising sol. is made by dissolving 1 part of conc. sulphuric acid and 1 part of pot. bichrom. in 20 parts of water.	Caustic alkalies and carbonates.	Quinone is recognised by its pungent smell, which is readily given off on heating to boiling aqueous solutions.

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME.	BEHAVIOUR TO ALKALIES.	BEHAVIOUR TO OXIDISING SUBSTANCES.	USED AS A DEVELOPER IN CONJUNCTION WITH—	REMARKS.
METOL.	Aqueous solutions of metol, which also contain a large proportion of neutral sulphites or alkaline carbonates, contain the metol in the form of the free base.	Gives quinone on oxidation. Metol is, therefore, a phenol derivative, and not a cresol derivative, as is frequently assumed.	Alkaline carbonates.	If an aqueous sol. of metol be acidulated with dilute sulphuric acid, and some nitrite sol. added, the nitroso compound of metol $\left(C_6H_4\genfrac{}{}{0pt}{}{OH}{NCH^3}N\right)$ separates out in fine felted needles. Ethereal sol. of the metol base on evaporation leaves the metol in the form of an oily liquid, which sets, on standing, into long rosette-shaped crystals.
ORTOL.	—	Gives, on oxidation with bichromate and sulphuric acid, a deep Bordeaux red colour, and also quinone.	Alkaline carbonates.	—
PARA-AMIDO-PHENOL.	Alkaline sulphites and carbonates ppt. the free base from concentrated aqueous solution; caustic alkalies also ppt. the free base, which is again dissolved on further addition with the formation of phenolate.	Oxidation easily produces quinone. On the addition of chloride of lime sol. to a sol. para-amidophenol mixed with hydrochloric acid, a deep violet colour is first formed, and, on further addition, yellow flocks of chloranide quinone separate.	Caustic carbonates and alkalies.	If a solution of hydrochlorate of para-amidophenol be acidulated with hydrochloric or sulphuric acid, and some nitrite solution added till the smell of nitrous acid is recognised, a diazo compound is formed in the solution which, with Andresen's α-naphthol-disulphonic acid, gives, in caustic alkaline solutions, a ponceau red dye.

ORANGE CAMERA CLUB

PARA-PHENYLENDIAMINE.	Separated by ether and also from alkaline caustic solutions.	Gives quinone on oxidation. Chloride of lime sol. produces, in a sol. acidulated with hydrochloric acid, quinone dichlordiamide, which separates in yellow flocks.	Caustic alkalies.	The diazo compound of para-phenyl-endiamine gives with Andresen's α-naphthol-disulphonic acid a red-violet colour (compare para-amidophenol). The shade of this dye is best determined by pouring some of the sol. on filtering paper, and dropping dilute acetic acid on the place.
PYROGALLOL.	Sulpho-pyrogallol solutions become brown on addition of a few drops of caustic soda. Pyro is separated by ether from sulphite sol., but not from sulphite and potash solutions.	Gives no quinone.	Alkali carbonates and ammonia.	If a dilute solution of pyro is mixed with a concentrated solution of ferrous sulphate which has become superficially oxidised, there is formed after a short time a beautiful blue colour.
TRI-AMIDO-PHENOL.	A sulphite sol. is yellowish. By addition of potash the colour becomes green, by adding caustic alkalies it becomes brown. The colours are very distinct if filtering paper be saturated with the solutions and exposed to the air.	One drop ferric chloride sol. produces a dilute aqueous sol. a deep blue colour. No quinone formed.	Neutral alkaline sulphites.	—

(*aa*) The brown colour remains and quickly increases = pyrogallol. Test further by special reactions.

(*bb*) The brown colour turns blue = di-amido-resorcin.

3. The solution remains clear and bright, without any colour—brenzcatechine, hydroquinone, metol, ortol, para-amidophenol (when very dilute), or para-phenyl-endiamine. Test the original substance as to the evolution of quinone by oxidation with potassium bichromate and sulphuric.

(*a*) If no quinone is formed = brenzcatechine. Test with ferric chloride and lead acetate.

(*b*) If quinone is formed by oxidation = hydroquinone, metol, ortol, para-amidophenol, para-phenyl-endiamine.

Add to the aqueous solution of the substance some dilute sulphuric acid and shake with ether.

(*aa*) If on the evaporation of the ether a residue of long needles is left = hydroquinone or ortol. Test for the same. If the hydroquinone comes from the ortol, the original substance will give, on oxidation, the Bordeaux red colour mentioned in the table.

(*bb*) There is no residue, or but little, after evaporation of the ether = metol, para-amidophenol, or para-phenyl-endiamine. Prepare a 1 : 20 solution of the substance, add some dilute sulphuric acid, and cool the solution by the addition of ice, and then add, with stirring, as much concentrated nitrite solution to make it smell of nitrous acid.

(*aa*) If a felted mass of fine needles, separates = metol. Test according to table.

(*bb*) If there is no separation = para-amidophenol or para-phenyl-endiamine. To some of the clear solution, containing nitrite, add some solution of *α*-naphthol-disulphonic acid (known also as Andresen's acid), made alkaline with caustic alkali.

1. The azo dye formed is of a ponceau red shade = para-amidophenol.
2. The azo dye formed is of a Bordeaux red colour = para-phenyl-endiamine.

B. THE DEVELOPER TO BE TESTED IS AN AQUEOUS SOLUTION.

As aqueous solutions of developing agents generally possess keeping properties only in the presence of sulphites, these will be found in all liquid developers. In order to test this, it is only necessary to acidulate a small quantity of the solution with dilute sulphuric, and the smell of sulphurous acid will prove the presence of sulphite.

To recognise the developing agent, place a small quantity of the original solution in a little dish, and add a little concentrated caustic soda lye.

(*A*) If the solution assumes gradually an intense colour on exposure to the air.

(*a*) If the colour is an intense blue = di-amido-resorcin, a small quantity of the original solution should be acidulated with dilute sulphuric acid, and the solution boiled to drive off the sulphuric acid, a couple of drops of ferric chloride solution, and strongly diluted with water. The solution will then assume the characteristic colour given in the table.

(*b*) The solution, when in contact with the air, quickly turns brown = pyrogallol, amidol, or tri-amidophenol. A small quantity of the original solution should be placed in a dish, and a lot of dry carbonate of potash added.

1. The solution turns blue = amidol. Test further as with diamido-resorcin, or extract some of the original sulphite solution with ether, evaporate the latter, and dissolve the residue with water. Ferric chloride gives a red colour.

2. The solution turns brown on exposure to the air = pyrogallol. In order to confirm this, acidulate a small quantity of the original solution with hydrochloric acid extract with ether, dissolve the residue after evaporation of the ether in water, and test as suggested in the table with oxidised sulphate of iron.

3. The solution turns a smutty green = tri-amidophenol. In this case the original solution is more yellow than the former. Test further with ferric chloride as suggested for di- amido-resorcin.

(*b*) Soda lye produces no marked change of colour = brenzcatechine, di-amido-oxyphenol, eikonogen, glycin, hydroquinone, metol, ortol, para-amidophenol, para-phenyl-endiamine.

Add to some of the original solution some hydrochloric acid, slowly and with constant stirring, and note if any separation takes place, and then note if the precipitate dissolves in excess of acid.

(*a*) If a white precipitate is formed = di-amido-oxyphenol, eikonogen, glycin, para-amidophenol.

1. The precipitate formed does not dissolve in excess of hydrochloric acid = eikonogen.

2. The precipitate dissolves on addition of more hydrochloric acid = di-amido-oxyphenol, glycin, and para-amidophenol.

(*aa*) The precipitate does not dissolve on addition of strong acetic acid = glycin.

(*bb*) The precipitate dissolves in excess of acetic acid = para amido-phenol, di-amido-oxyphencl.

Acidulate a small quantity of the original solution with dilute sulphuric acid, drive off the free sulphuric acid by boiling, and add to the boiling hot solution some potassium bichromate.

(*cc*) The solution smells of quinone = para-amidophenol.

(*dd*) There is no smell of quinone = di-amido-oxyphenol.

(*B*) No precipitate is formed on the addition of hydrochloric acid to the original solution = brenzcatechine, hydroquinone, metol, ortol, or para-phenyl-endiamine.

Acidulate a small quantity of the original solution with hydrochloric acid, and shake with ether.

1. If a precipitate is left on evaporation of the ether = brenzcatechine, hydroquinone, ortol.

The residue gives quinone = hydroquinone or ortol. Acidulate a small quantity of the original solution with sulphuric acid, boil off the free sulphurous acid, and oxidise with potassium bichromate. If the red colour mentioned in the table appears, it is ortol; in the other case, hydroquinone.

(*b*) The residue gives quinone = brenzcatechine. Test with ferric chloride and acetate of lead.

2. If there is no marked residue on evaporation on the ether = metol or para-phenyl-endiamine. Acidulate a small quantity of the original solution with dilute sulphuric acid, boil off the free sulphurous acid,

and add to the liquid cooled with ice some solution of nitrate till it smells of nitrous acid.

(*a*) If, after the addition of the nitrate, a compound separates out (nitros-metol) = metol. This is proved by no colour being formed in a caustic alkaline solution with *a*-naphthol- ε disulphonic acid.

(*b*) The solution containing nitrate gives, when poured into a caustic alkaline solution of *a*-naphthol ε disulphonic acid, a red-violet colour = paraphenyl-endiamine.

In the above notes the method of analysis is given when only one developing agent is present in the secret preparation. It is rather more trouble when two or more reducing agents are present; still the data in the table will be of some assistance, and they may be tested for separately.

GEOLOGICAL PHOTOGRAPHS.

THIS Committee was appointed by the British Association for the Advancement of Science in 1889, for the purpose of arranging for the collection, preservation, and systematic registration of photographs of geological interest in the United Kingdom.

Since its formation the Committee has been successful in obtaining a number of photographs, of which 2000 were received and registered up to the month of August, 1898, when the ninth report was presented at the Bristol meeting of the British Association.

The collection cannot yet be regarded as in any sense complete, for many districts are still poorly represented in it. A great effort is being made to fill up the numerous lacunæ.

The Committee would, therefore, urge upon geologists and photographers the desirability of further assisting the scheme, with the object of completing a national collection of photographs to illustrate the geology of our own country.

The collection has been deposited at the Museum of Practical Geology, 28, Jermyn Street, London, where it is accessible to the public for purposes of reference.

It is desired to obtain photographs illustrative of characteristic rock exposures, especially those of a typical character or temporary nature; important boulders; localities affected by denudation, or where marked physiographical changes are or have been in operation; landslips; raised beaches; old sea-cliffs and other conspicuous instances of marine erosion; characteristic river valleys or escarpments, and the like; types of rock-structure, jointing, folding, and faulting; glacial phenomena, such as *roches moutonnées*, moraines, drums, and eskers; or any natural views of geological interest. Photographs of microscopical sections and typical hand specimens of rocks and fossils are also admissible.

It is important that copies of photographs which have been processed for illustrating articles and papers in journals should be deposited in the collection; they should be accompanied by an exact reference to the publication, and, if possible, a copy of the plate.

Duplicate collections of about 200 prints and about 100 slides have been formed, and the Secretary will gladly forward either or both of them to any local society that contemplates joining in the work, or wishes to see what has already been done.

APPARATUS FOR GEOLOGICAL PHOTOGRAPHY.

The Committee has had under consideration the question of the most suitable form of camera for geological field work. The following is a *précis* of communications from experts who have been invited to offer suggestions on the subject.

The *best camera* to use is probably that to which the worker is himself most accustomed. These hints are added for those who have not yet adopted any particular camera.

The camera should be as light as possible, but *rigidity* when set up is absolutely necessary.

Double swing-back and rising and falling front are essential, to allow of correct perspective and the true rendering of lines and curves.

The camera should admit of long extension to permit the use of lenses of various *foci*.

It is sometimes desirable to take photographs of inclined or horizontal rock-surfaces at distances of a few feet, for the purpose of showing minor features, such as veins, glacial markings, structures of gneissose rocks, &c. To effect this, two boards hinged together with some arrangement for fixing them at the desired angle are all that is required. The lower board must, of course, be screwed to the stand and the upper one to the camera.

A spirit level should be used with the camera or attached to it.

It is well to have three lenses: (1) A rapid rectilinear doublet of 10 to 12-inch focus (for half-plate size); (2) a wide-angle meniscus, focal length about 6 to 7 inches, for interiors of quarries and craters; and (3) a long-focus lens of focal length equal to three or four times the length of the plate, for distant hills and inaccessible cliffs.

If only one lens is used, it should be a rapid rectilinear of about 9-inch focal length (for half-plate size), and should be by some reputable maker. It must be the best of its kind obtainable. Though films materially decrease the weight to be carried, they are not recommended for general use; plates should be used whenever possible. Good general work can be done with a quarter-plate or 5 x 4 camera, and subsequent enlargement on bromide paper. In this case it is essential that the lens should be of first-rate make, and be used with a small stop. For direct printing, the cold-bath platinotype method is recommended as the most permanent, and it is now very easy to work.

It is advisable, when measurements are unattainable, that a "scale object" should be included in the photograph. (A hammer is sometimes used, but it is not suitable; a walking-stick or a human figure seems to be satisfactory.)

RECOMMENDATIONS FOR THE COLLECTION OF GEOLOGICAL PHOTOGRAPHS.

(1) Societies are urged to form small committees for the purpose of noting sections suitable to be photographed, and arranging such work as may be possible in each district. To this end it is anticipated that the services of many amateur photographers may be secured.

(2) Size of photograph recommended, 8½ x 6½ inches ("whole-plate"); but this is *optional*. In view of the difficulty of carrying a heavy camera and plates, it is not desired to exclude smaller views when these are well defined and clear. In the case of small negatives, when sharp, an enlargement to whole-plate size is desirable. The views should be printed by a permanent process whenever practicable. Isochromatic plates are strongly recommended.

(3) In order to preserve its scientific value, each photograph should be

accompanied by *as many* of the following details *as can be conveniently given.* Forms for this purpose will be supplied on application.

(*a*) Name and position of section or locality.

(*b*) Special features shown, with illustrative diagrams when necessary. (Further details may be given, if more convenient, on a separate tracing.)

[*Reduced Copy of* FORM A.]

FORM A BRITISH ASSOCIATION COMMITTEE ON GEOLOGICAL PHOTOGRAPHS.			Loca No.
County.		Photographed under the direction of	
Name and position of Locality or Section.			
Special features shown.			
Details of Section.	Height. Length.	Compass Direction. Camera Pointing.	"In shade" or "direct light." Time : a.m. p.m.
Sketch, or other particulars, if necessary, may be given here :—			
Name of Photographer. Address.	Date photographed.		Registered No.

* This number should also be placed on the back of the Photograph.

NOTE.—Copies of the above Form will be supplied on application to the Secretary, to enable the Donors of Photographs to insert the requisite particulars.

(*c*) Height and length of section, and compass direction. If possible, a scale of some kind should always be given.

(*d*) Name and address of photographer, or of the society under whose direction the view is taken.

(*e*) Date when photographed.

(*f*) Indication of direction of light and shade; *i.e.*, state whether taken in "direct light" or "in shade."

(4) Each photograph sent in for registration should bear a *local* number, and the accompanying form should be numbered at the top right-hand corner in accordance therewith.

(5) Photographs should be sent *unmounted*. This is essential in order to secure the proper geographical arrangement of the collection. They will be mounted by the Committee on cards of uniform size, with perforated edges for binding, to hold one whole-plate, two half-plate, or four quarter-plate views.

(6) Copies of photographic prints, lists of photographs, and information relative thereto, should be sent under cover to the Secretary of the Committee, at the earliest possible date, in order to facilitate the work of registration. They should be sent in *not later than August* 1 in each year.

(7) It adds very much to the usefulness of the collection when amateurs are willing to place their negatives, or copies of them, in the hands of a professional photographer, with instructions to supply prints or lantern slides, at a price, to those who apply for them. The Secretary would willingly help in giving advice on this point, as he is frequently asked where copies of the contributed prints can be obtained.

Detailed lists of photographs officially received are published in the annual reports of the Committee, which also states where the photographs may be obtained. These reports are published in the "Annual Report" of the British Association, and a copy will be forwarded to the donor of each photograph.

Further information may be obtained from the members of the Committee, or from the Secretary, W. W. Watts, Mason University College, Birmingham, to whom communications should be addressed.

FORMULÆ.

WITH the view of enabling readers of the ALMANAC to find any particular one of the following numerous Formulæ or Tables, we give below an Index to the Contents of this section of the ALMANAC, which will doubtless facilitate reference.

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ABOUT WEIGHTS AND MEASURES

The inconveniences of the English system of weights and measures has long been felt by all who are engaged in any form of research. It is not a question of the units so much as of their divisions. If it were only a matter of English convenience, there would probably be little desire to change the pound and the yard, which are our standards, and it would only be a question of dividing them suitably. But decimal division and multiplication of these units, or their subordinate ones, is practically impossible to avoid, and no one can help feeling the advantage which would follow from universal decimalisation, at least no one who has much to do with the calculations necessary for modern science, which reduces all things to number, weight, and measure. If this decimalisation were taken in hand with our present units (standards), it would be necessary to devise new names for some subordinate units, and to make them such as would clearly distinguish them from the old system. No one surely would seriously propose to deliberately add to the confusion we already enjoy of having two ounces, three drachms, and two pounds (not to speak of the monetary unit represented by a sovereign) which are a constant source of confusion, even though some of these are not sanctioned by law. Besides, if we retain our units, we should still be under the disadvantage in our commerce of differing in our units from all our neighbours, and in our science of want of ready connexion between our units of length and weight. There have been several suggestions made for decimalising our weights; of these the best probably was that the avoirdupois pound, of 7,000 grains, should be divided into 1,000 parts, to be called septems, and that the measure of fluids should correspond to a pound of pure water and be divided similarly, but nothing has ever come of this. Recently, indeed, a proposal was made to adopt a new pound of 8,000 grains, divided into 16 ounces of 500 grains each, thus adding to our confusion for the sole purpose of getting an ounce of a round number of grains, for it is difficult to see what other gain there would be.

If there is to be a change, then, the new system should be free from as many as possible of the disadvantages of what we have, and not be liable to require further modification. One solution only seems possible, and that is that Englishmen take the advice of, and follow the practice of, the most scientific portion of their body, and adopt the metric system in its entirety. The units are not practically inconvenient, nor are the names of them really difficult to deal with; and, if they were so, objections would come with a bad grace from photographers, whose journals teem with words of Greek and Latin derivation, awful to look at and far worse to pronounce than kilo, gramme, metre, litre, or c. c.

Whether our readers are prepared to go the whole length with us or no (and the retention of the old forms should meet the convenience of the most conservative) we think there is another convenience arising from the step now taken. It must be well known to all that the use of percentages, and even of what are called parts, has become a practice in photographic work. What the advantage of parts, as lately used, is we fail to see; but the use of percentages is a practical confession of the advantage of decimilation. It is proposed to adopt here one uniform quantity of the solution to be made up, that is the litre of 1000 cubic centimetres, and containing 1000 grammes of pure water. The quantities if each constituent will be given in grammes or cubic centimetres (c. c.), according as it is solid or fluid, and, as a rule, fractions of a gramme will be neglected.

The English grains per ounce have been converted into grammes per litre by multiplying them by 16·7, and drops per ounce into c. c. per litre by the factor 25·12.

It has been suggested that the accuracy of these conversions is excessive, but it has been thought better to leave the expert to adopt more convenient figures, rather than to make the author of a formula responsible in appearance for what he did not sanction. In a few cases where the author has given his formula both in English and metric form, his equivalents have been adhered to, and it is hoped that this practice will be more general in future.

Those who prefer percentages will find their wants met if they bear in mind that one-tenth of the quantities given will make 100 c.c. of solution, and be, in fact, percentages. The gentlemen who wish to make use of parts will find that, by reading *parts* for grammes or c. c. they will have formulæ quite as accurate as those they have been in the habit of using.

In some cases there is a doubt whether the author of a formula means that the solution should be made up to the quantity directed to be made, or whether he means the amount of water specified to be added. It would be accordant with uniformity to take the latter view; in many cases it does not much matter which is taken, but when there is a large quantity of water of crystallisation in the substance used, it may be material, and it would be very desirable if all photographers would distinctly state which mode of mixing they mean to be followed. Where sodium sulphite, for instance, is employed in crystals, no less than half the weight is water. In this common salt it is stated in the Solubility Tables that a saturated solution contains twenty-five per cent., but much stronger solutions are prescribed, in one case fifty per cent. is ordered in a standard work on our art. In this case, if 5 parts of salt (in crystals) is dissolved in hot water and the solution made up to 10 parts, we have virtually 2.5 parts of the anhydrous salt in the 10 parts, that is, a twenty-five per cent. solution, saturated at ordinary temperatures but liable to change when it is cold; but if 10 parts of water are used to dissolve the 5 of salt, the solution will only contain twenty per cent. of anhydrous salt, and probably would always be unchanged in any work room.

NEW METRIC WEIGHTS AND MEASURES.

[From the Journal of the Royal Photographic Society.]

IN accordance with a resolution passed by the Council of this Society, directing the publication, in the JOURNAL, of the Order in Council dated May 19, 1898, substituting a new table of imperial and metric equivalents for that set forth in Part. I. of the Third Schedule of the Weights and Measures Act, 1878, we give below an abstract from the new Schedule of such measures of weight, length, capacity, &c., which are in common use amongst photographers in this country.

Equivalents of Metric Weights and Measures in Terms of Imperial Weights and Measures.

LINEAR MEASURE.

1 Millimetre(Mm.)(1/1000th M.)	=	0·03937 Inch.
1 Centimetre (1/100th M.)	=	0·3937 ,,
1 Decimetre (1/10th M.)	=	3·937 Inches
1 Metre (M.)	=	39·370113 Inches 3.280843 Feet 1·0936143 Yards
1 Dekametre (10 M.)	=	10·936 Yards
1 Hectometre (100 M.)	=	109·36 ,,
Kilometre (1000 M.)	=	0·62137 Mile

SQUARE MEASURE.

1 Square Centimetre	=	0·155 Square Inch
1 ,, Decimetre (100 Sq. Centimetres)	=	15·5 Square Inches
1 Square Metre (100 Square Decimetres)	=	10·7639 Square Feet 1·196 Square Yards

CUBIC MEASURE.

1 Cubic Centimetre	=	0·061 Cubic Inch
1 ,, Decimetre(C.D.)(1000 Cubic Centimetres)	=	61·024 Cubic Inches
1 Cubic Metre (1000 Cubic Decimetres)	=	35·3148 Cubic Feet 1·307954 Cubic Yards

MEASURE OF CAPACITY.

1 Centilitre (1/100th Litre)	=	0·07 Gill
1 Decilitre (1/10th Litre)	=	0·176 Pint
1 Litre	=	1·7598 Pint
1 Dekalitre (10 Litres)	=	2·2 Gallon

WEIGHT. *Avoirdupois.*

1 Milligramme(1/1000thGrm.) = 0·015 Grain
1 Centigramme(1/100th Grm.) = 0·154 ,,
1 Decigramme (1/10th Grm.) = 1·543 Grains
1 Gramme (1 Grm.) .... = 15·432 ,,
1 Dekagramme (10 Grm.) ... = 5·644 Drachms
Hectogramme (100 Grm.)... = 3·527 Ounces
1 Kilogramme (1000 Grm.)... = 2·2046223 lbs. or
= 15432·3564 Grains
1 Quintal (100 Kilog.) .... = 1·968 Cwt.

Apothecaries'.

1 Gramme (1 Grm.) .... = 0·2572 Drachm
= 0·7716 Scruple
= 15·432 Grains

Troy.

1 Gramme (1 Grm.) .... = 0·03215 Ounce

Equivalent of Imperial Weights and Measures in Terms of Metric Weights and Measures.

LINEAR MEASURE.

1 Inch .... = 25·4 Millimetres
Foot .... = 0·3048 Metre
1 Yard .... = 0·914399 ,,
1 Mile .... = 1·6093 Kilometre

SQUARE MEASURE.

1 Square Inch...................... = 6·4516 Square Centimetres
1 ,, Foot...................... = 9·2903 ,, Decimetres
1 ,, Yard...................... = 0·836126 ,, Metre
1 ,, Mile .... = 259·0 Hectares

CUBIC MEASURE.

1 Cubic Inch .... = 16·387 Cubic Centimetres
1 ,, Foot .... = 0·028317 Cubic Metre
1 ,, Yard .... = 0·764553 ,, ,,

MEASURES OF CAPACITY.

1 Pint .... = 0·568 Litre
1 Quart .... = 1·136 ,,
Gallon .... = 4·5459631 Litres

APOTHECARIES' MEASURE.

1 Minim .... = 0·059 Millilitre
1 Fluid Scruple .... = 1·184 ,,
1 ,, Drachm (60 Minims) = 3·552 Millilitres
1 ,, Ounce (8 Drachms)... = 2·84123 Centilitre
1 Pint .... = 0·568 Litre

AVOIRDUPOIS WEIGHT.

1 Grain .... = 0·0648 Gramme
1 Ounce .... = 28·350 Grammes
1 Pound............................. = 0·45359243 Kilogramme
1 Hundredweight .... = 50·80 Kilogrammes

APOTHECARIES' WEIGHT.

1 Grain .... = 0·0648 Gramme
1 Scruple (20 Grains) .... = 1·296 Grammes
1 Drachm (3 Scruples) .... = 3·888 „
1 Ounce (8 Drachms)........... = 31·1035 „

Note.—The Metre is represented by the distance marked by two fine lines on the iridio-platinum standard bar numbered 16, when at the temperature of 0° Centigrade. This bar is deposited with the Board of Trade. The metre is the only unit of metric measure of extension from which all other metric measures of extension, whether linear, superficial, or solid, shall be ascertained.

The Kilogramme is represented by the cylindrical iridio-platinum standard kilogramme weight numbered 18, which is deposited with the Board of Trade. The kilogramme is the only unit of metric weight from which all other metric weights, and all measures having reference to metric weight, shall be ascertained.

The Litre is represented by the capacity at 0° Centigrade of the cylindrical brass measure marked "litre, 1897" (which is deposited with the Board of Trade), and having a diameter equal to one-half its height. This litre at 0° Centigrade when full contains one kilogramme of distilled water at the temperature of 4° Centigrade, under an atmospheric pressure equal to that represented by a column of mercury 760 millimetres high at 0° Centigrade at sea-level, and at latitude 45°, the weighing being made in air, but reduced by calculation to a vacuum. It is the only unit of metric measure of capacity from which all other metric measures of capacity, as well for liquids as for dry goods, shall be ascertained.

English Measures compared with one another and with Metric.

AVOIRDUPOIS.					APOTHECARIES'.				
Oz.	Drs.	Grns.	Grms.		Grms.	Grns.	Scpls.	Drs.	Oz
		1	·0648	1 Grn.	·0648	1			
				1 Scpl.	1·296	20	1		
	1	27·34375	1·7718	1 Dm.	3·888	60	3	1	
1	16	437·5	28·3495	1 Oz.	31·103	480	24	8	
16	256	7000·	453·5926	1 Pnd.	373·242	5760	218	96	11

LIQUID.

Cubic Centimetres.	Minims.	Drachms.	Ounces.	Pints.	Gallon.
·0591	1				
3·5492	60	1			
28·3939	480	8	1		
567·878	9600	160	20	1	
4543·0	76800	1280	160	8	1

English compared with Metric,

AVOIRDUPOIS.

Drachms.	Grammes.	Ounces.	Grammes.
1	1·7718	1	28·3495
2	3·5437	2	56·6991
3	5·3155	3	85·0486
4	7·0874	4	113·3982
5	8·8592	5	141·7476
6	10·6310	6	170·0971
7	12·4029	7	198·4468
8	14·1748	8	226·7963
9	15·9466	9	255·1458
10	17·7184	10	283·4952
11	19·4902	11	311·8447
12	21·2622	12	340·1945
13	23·0340	13	368·5440
14	24·8058	14	396·8935
15	26·5776	15	425·2430
16	28·3495	16	453·5926

1 lb. equals 453·5926 grammes.

APOTHECARIES WEIGHT.

Grains.	Grammes.
1	·0648
2	·1296
3	·1944
4	·2592
5	·3240
6	·3888
7	·4536
8	·5184
9	·5832
10	·6480
11	·7128
12	·7776
13	·8424
14	·9072
15	·9720
16	1·0368
17	1·1016
18	1·1664
19	1·2312
20	1·2960

Scruples.	Grammes.
1	1·2960
2	2·5920
3	3·8879

Drachms.	Grammes
1	3·8879
2	7·7759
3	11·6637
4	15·5516
5	19·4395
6	23·3274
7	27·2153
8	31·1035

Ounces.	
1	31·1035
2	62·2070
3	93·3105
4	124·4140
5	155·5175
6	186·6210
7	217·7245
8	248·8280
9	279·9315
10	311·0305
11	342·1385
12	373·2420

1 lb. equals 373·2420.

TABLE FOR THE CONVERSION OF ENGLISH WEIGHTS AND MEASURES IN THE METRICAL SYSTEM.*

LIQUID MEASURE.

Minims.	c.cm.
1	0·0591
2	0·1183
3	0·1775
4	0·2366
5	0·2957
6	0·3549
7	0·4141
8	0·4732
9	0·5324
10	0·5915
11	0·6507
12	0·7098
13	0·7690
14	0·8282
15	0·8873
16	0·9465
17	1·0056
18	1·0648
19	1·1239
20	1·1831
21	1·2422
22	1·3014
23	1·3605
24	1·4197
25	1·4789
26	1·5380
27	1·5972
28	1·6563
29	1·7155
30	1·7746
31	1·8338
32	1·8929
33	1·9521
34	2·0112
35	2·0704
36	2·1295
37	2·1887
38	2·2478
39	2·3070
40	2·3662
41	2·4253
42	2·4845
43	2·5436
44	2·6028
45	2·6619
46	2·7211
47	2·7802
48	2·8394
49	2·8985
50	2·9577
51	3·0169
52	3·0760

Minims.	c.cm.
53	3·1352
54	3·1943
55	3·2535
56	3·3126
57	3·3718
58	4·4309
59	3·4901
60	3·5492

Drachms.	c.cm.
1	3·5492
2	7·0985
3	10·6477
4	14·1970
5	17·7462
6	21·2954
7	24·8447
8	28·3939

Ounces.	c.cm.
1	28·394
2	56·788
3	85·182
4	113·576
5	141·970
6	170·364
7	198·757
8	227·151
9	255·545
10	283·939
11	312·333
12	340·727
13	369·120
14	397·515
15	425·909
16	454·303
17	482·697
18	511·091
19	539·484
20	567·878

Pints.	c.cm.
1	567·9
2	1135·8
3	1703·6
4	2271·5
5	2839·4
6	3407·3
7	3975·1
8	4543·0

LINEAL MEASURE.

Inches.	Feet.	Yards.	Fathoms.	m.
1 =	0·083 =	0·0278 =	0·0139 =	0·0254
12 =	1 =	0·333 =	0·1667 =	0·3048
36 =	3 =	1 =	0·5 =	0·9144
72 =	6 =	2 =	1 =	1·8287

AVOIRDUPOIS WEIGHT INTO GRAMMES.

Drachms.	Ounces.	Pounds (lbs.)	g.
1 =	0·0625 =	0·0039 =	1·77185
16 =	1 =	0·0625 =	28·3495
256 =	16 =	1 =	453·59

APOTHECARIES' WEIGHT.

Grains.	Scruples.	Drachms.	Ounces.	Pounds.	g.
1	0·05	0·0167	0·00209	0·00017	0·0648
20	1	0·334	0·0418	0·00347	1·2960
60	3	1	0·125	0·01042	3·8879
480	24	8	1	0·08333	31·103
5760	218	96	12	1	373·236

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* See also pp, 671-674; 1074-75.

TABLE FOR CONVERTING GRAINS AND DROPS PER OUNCE INTO GRAMMES PER LITRE AND *VICE VERSA*.

1000 : 480	1000 : 437½		437½ : 1000	480 : 1000
3/25	7/64	1/4	4/7	25/48
4/25	7/48	1/3	16/21	25/36
6/25	7/32	1/2	1 1/7	1 1/24
8/25	7/24	2/3	1 11/21	1 7/18
9/25	21/64	3/4	1 5/7	1 9/16
12/25	7/16	1	2 2/7	2 1/12
24/25	7/8	2	4 4/7	4 1/6
1 11/25	1 5/16	3	6 6/7	6 1/4
1 23/25	1 3/4	4	9 1/7	8 1/3
2 2/5	2 3/16	5	11 3/7	10 5/12
2 22/25	2 5/8	6	13 5/7	12 1/2
3 9/25	3 1/16	7	16	14 7/12
3 21/25	3 1/2	8	18 2/7	16 2/3
4 8/25	3 15/16	9	20 4/7	18 3/4
4 4/5	4 3/8	10	22 6/7	20 5/6
5 7/25	4 13/16	11	25 1/7	22 11/12
5 19/25	5 1/4	12	27 3/7	25
6 6/25	5 11/16	13	29 5/7	27 1/12
6 18/25	6 1/8	14	32	29 1/6
7 1/5	6 9/16	15	34 2/7	31 1/4
7 17/25	7	16	36 4/7	33 1/3
8 4/25	7 7/16	17	38 6/7	35 5/12
8 16/25	7 7/8	18	41 1/7	37 1/2
9 3/25	8 5/16	19	43 3/7	39 7/12
9 3/5	8 3/4	20	45 5/7	41 2/3
14 1/25	13 1/8	30	68 4/7	62 1/2
19 1/5	17 1/2	40	91 3/7	83 1/3
24	21 7/8	50	114 2/7	104 1/6
28 4/5	26 1/4	60	137 1/7	125
33 3/5	30 5/8	70	160	145 5/6
38 2/5	35	80	182 6/7	166 2/3
43 1/5	39 3/8	90	205 5/7	187 1/2
48	43 3/4	100	228 4/7	208 1/3
52 1/2	47 109/128	109 3/8	250	227 83/96
57 3/5	52 1/2	120	274 2/7	250
70	63 77/96	145 5/6	333 1/3	307 1/4
76 4/5	70	160	365 5/7	333 1/3
105	95 45/64	218 3/4	500	455 35/48
115 1/5	105	240	548 4/7	500
120	109 3/8	250	571 3/7	520 5/6

When a number in the central column is that of the grains per avoirdupois ounce, the proportionate number of grammes per litre will be found next to it on the *right* hand.

When a number in the central column is that of the grammes per litre, the proportionate number of grains per avoirdupois ounce will be found next to it on the *left* hand.

Thus, 70 grains per ounce (central column) are equivalent to 160 grammes per litre (right hand).

Again, 16 grammes per litre (central column) are equivalent to 7 grains per avoirdupois ounce (left hand).

The outer columns may be used in conjunction with the central one in the same way, to convert drops per fluid ounce into c.c. per litre and *vice versâ.*

WEIGHTS AND MEASURES.

By the Weights and Measures Act, 1878 (41 and 41 Vict., c. 49), every contract, bargain, or dealing, for any work done, goods, wares, or merchandise sold, &c., by weight or measure, shall be according to the weights or measures ascertained by this Act, and, if not so made, shall be void.

No local or customary measures, nor the use of heaped measure, shall be lawful.

Any person who sells by any denomination of weight or measure other than one of the Imperial weights or measures, shall be liable to a fine of 40*s.* for every such sale.

All articles sold by weight shall be sold by Avoirdupois weight; except that—

1. Gold and silver, and articles made thereof, also platinum, diamonds, and other precious metals or stones, may be sold by the oz. Troy, or the decimal parts of such oz.
2. Drugs, when sold by retail, may be sold by Apothecaries' weight.

Nothing in this Act shall prevent the sale or subject a person to a fine for the sale of an article in any vessel not represented as containing any amount of Imperial measure.

Every person who uses or has in his possession for use for trade, a weight or measure which is not of the standard denomination, shall be liable to a fine of £5, and for a second offence £10.

UNJUST WEIGHTS AND MEASURES.

Every person who uses or has in his possession for use for trade, any weight, measure, or scale, &c., which is false or unjust, shall be liable to a fine of £5, and for a second offence, £10; and any contract, sale, or dealing made by the same shall be void.

STAMPING AND VERIFICATION OF WEIGHTS AND MEASURES.

All weights and measures must have the denomination thereof stamped thereon.

Every weight and measure whatsoever, used for trade, shall be verified and stamped, by an inspector, with a stamp of verification.

Any person who uses, or has in his possession for use, for trade, any measure or weight, not duly stamped, shall be liable to a fine of £5 for the first offence, and £10 for the second.

The above has been extracted from "Every Man's Own Lawyer." We may add that the working of the Act is under the Board of Trade, and that all details are prescribed by Orders in Council. The King in Council has power to sanction certain things, and by an Order of this sort, dated 19th May last, the use of Metric weights and measures was sanctioned. The making of Metric standards was sanctioned by the Weights and Measures Act, of 1897. The equivalents to be used in future (in lieu of those prescribed by the Act of 1878) are directed in a subsequent Order, and are those given in p. 582 of the ALMANAC for last year.

DARK-ROOM TABLE.

By CHARLES LOUIS HETT.

FOR the reduction of formulæ given in Avoirdupois and Liquid Measure into proportional parts. It is arranged so that any formula for the usual 20 ounces (1 pint) solution will, when converted, give the number of grammes or cubic centimetres in a litre of mixture. When the original formula is for any other quantity, the resulting proportions may still be used for grammes and cubic centimetres; or they may be further calculated to adjust the bulk to 1,000 parts. This conversion is shown in part B of the example.

NUMBER OF		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WEIGHTS.	Grains	0·34	0·46	0·57	0·68	0·80	0·91	1·03	1·14	1·26	1 37	1·49	1·60	1·71	1·83	1·94	2·06	2·17	2·29
	Drachms (27 $\frac{11}{32}$ grains)	9·38	12·5	15·6	18·8	21·9	25·0	23·1	31·2	34·4	37·5	40·7	43·8	46·9	50·0	53·1	56·3	59·4	62·5
	Ounces (437½ grains, 16 drachms)	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
MEASURES.	Minims ($\frac{175}{192}$ fluid grains)	0·31	0·42	0·52	0·63	0·73	0·83	0·94	1·04	1·14	1·25	1·35	1·46	1·56	1·67	1·77	1·87	1·98	2·08
	Drachms (60 minims, 54 $\frac{11}{16}$ fluid grains) ..	18·7	25·0	31·3	37·5	43·7	50·0	56·3	62·5	68·7	75·0	81·2	87·5	93·7	100	106	113	119	125
	Ounces (480 minims, 8 drachms)........	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000

TONING AND FIXING BATH.

APPLICATION OF THE TABLE.

In the following example the third column shows the simple conversion by the table into proportional parts. The fourth gives the same, adjusted to 1,000 parts of water.

	1. Materials.	2. As commonly given.	3. Proportionate parts converted by table.	4. Last multiplied by $\frac{20}{4}=5$
A	Sodium tungstate	180 grs.	20·6 say 20	—
	Ammonium sulphocyanide .	300 grs.	34	—
	Hypo	6 ozs.	300	—
	Water	20 ozs.	1000	—
B	Gold chloride	15 grs.	1·71	8·55 say 9
	Water	4 ozs.	200·	1000

When in use, the quantity of gold constantly varies. Therefore 10 per 1000=1 per cent. may be used. A tube contains 1 gramme of gold chloride, and only requires to be dissolved in 100 c.c. of water.

For developing, use 100 c.c. conical graduated glass. A 500 c.c. measure is a convenience in making up solutions, but is by no means essential. Foreign medicinal water bottles contain 1 litre (1000 grammes or cubic centimetres) and are useful for solutions.

DEVELOPING FORMULÆ FOR GELATINE DRY PLATES, ETC.

THE following are a few of the typical formulæ that are generally employed for development, &c.; a much greater variety will be found in the section headed "Developing Formulæ of the Principal Platemakers" (p. 1122 *et seq.*), to which we also refer the reader.

PYRO SODA.

No. 1.	A.	Sulphite of soda	6 ounces	188 grammes.
		Water	32 ,,	1000 c. c.
		Pyrogallic acid	1 ounce	31 grammes.

(Having dissolved the sulphite of soda, add sufficient citric acid in solution to cause a piece of blue litmus paper inserted therein to become reddened.)

	B.	Carbonate of soda	3 ounces	94 grammes.
		Carbonate of potash	1 ounce	31 ,,
		Water	32 ounces	1000 c. c.

When about to develop, mix these in equal proportions with two parts the bulk of water, or, if the weather be *very* hot at the time, even a greater proportion of water.

No. 2.	A.	Sulphite of soda (crystals)	2 ounces	166 grammes.
		Citric acid	60 grains	11 ,,
		Ammonium bromide	40 ,,	8 ,,
		Pyro	1 ounce	83 ,,
		Water	12 ounces	1000 c. c.
	B.	Sulphite of soda (crystals)	2 ounces	166 grammes.
		Carbonate potassium (crys.)	3 ,,	250 ,,
		Water	12 ,,	1000 c. c.

To develop, use 1 drachm (or 6 c. c.) of each to 2 ounces (or 100 c.c.) of water.

PYRO AND AMMONIA.

No. 1.	Strong liquid ammonia	2 ounces	25 c. c.
	Bromide potassium	300 grains	9 grammes.
	Water	80 ounces	1000 c. c.
No. 2.	Pyrogallic acid	20 grains	4·6 grammes.
	Water	10 ounces	1000 c. c.
	Nitric acid	2 drops	0.5 ,

For use take equal parts.

FERROUS OXALATE.

No. 1.	Saturated solution of sulphate of iron............	1 part.
	Saturated solution of oxalate of potash	3 parts.

Mix *quant. suff.* by pouring the iron into the oxalate. In hot weather the proportion of the iron solution may be diminished with advantage

For Transparencies on Gelatino-Chloride Plates.

No. 2.	A.	Neutral oxalate of potash	2 ounces	100 grammes.
		Choride of ammonium ...	40 grains	4·5 ,,
		Distilled water...............	20 ounces	1000 c.c.
	B.	Sulphate of iron	4 drachms	34 grammes.
		Citric acid.....................	2 ,,	17 ,,
		Alum	2 ,,	17 ,,
		Distilled water...............	16 ounces	1000 c.c.

For black tones mix the above in equal volumes.

METOL.

Single-solution Developer.

Metol	40 grains	11 grammes.
Sulphite of soda	120 ,,	34 ,,
Hydroquinone	48 ,,	14 ,,
Carbonate of potash	240 ,,	69 ,,
Water............................	8 ounces	1000 c.c.

Apply heat if necessary to dissolve the metol, and afterwards add the sulphite, and allow that to dissolve before adding the other ingredients.

For use under normal conditions, one part of the above is to be diluted with three parts of water.

Two-solution Developer.

A.	Metol............................	40 grains	11 grammes.
	Hydroquinone...............	48 ,,	14 ,,
	Sulphite of soda............	120 ,,	34 ,,
	Water	8 ounces	1000 c.c.
B.	Carbonate of potash	1 ounce	13 grammes.
	Water	1 quart	1000 c.c.

For use, mix one part of A with three parts of B for ordinary exposures; for over-exposures use less of B, or else add a few drops of a ten per cent. solution of bromide of potassium, or of a five per cent. solution of citric acid; for slight under exposure, increase B.

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BEST PLATES FOR ALL-ROUND WORK.
EXTREME LATITUDE.
Admirable Results without Trouble.

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THREE-SOLUTION DEVELOPER.

A.	Metol	40 grains	11 grammes.
	Sulphite of soda	120 „	34 „
	Water	8 ounces	1000 c. c.
B.	Hydroquinone	40 grains	11 grammes.
	Citric acid	10 „	3 „
	Water	8 ounces	1000 c. c.
C.	Carbonate of potash	1 ounce	50 grammes.
	Water	20 ounces	1000 c. c.

For use under similar conditions to those already mentioned, take one part each of A and B and two parts of C.

METOL-HAUFF.

Solution A.

Water	100 parts	1000 c. c.
Metol	1 part	10 grammes.
Soda sulphite	10 parts	100 „

Solution B.

Water	100 parts	1000 c. c.
Carbonate potash (or substitute)	10 „	100 grammes.
Crystallised carbonate soda ...	20 „	200 „

For use, three parts A to one of B.

METOL-ANDRESEN.

Water	1 quart	1000 c. c.
Metol	¾ ounce	19 grammes.
Sulphite of soda	7 ounces	175 „
Carbonate of potash	3½ „	88 „
Bromide of potassium	1/10 ounce	2·5 „

For use, take one part of developer to three of water.

ILFORD EMPRESS PLATES

POPULAR PRICES.

THE PLATE FOR THE STUDIO.
FINE GRAIN.

ILFORD, LIMITED, ILFORD, LONDON, E.

To photographers who prefer to work with separate solutions the following is recommended :—

A. Water	1 quart	1000 c. c.
Metol	¾ ounce	19 grammes.
Sulphite of soda	7 ounces	175 „
B. Water	3 quarts	1000 c. c.
Carbonate of soda	7 ounces	58 grammes.

One part of A is mixed with three parts of water for use, bromide of potassium being as required for the prevention of fogging.

ANDRESEN'S GLYCIN.

I. For soft development :

Solution A (warm slightly).

Glycin	4 parts	40 grammes.
Carbonate of Potash	1½ „	15 „
Sulphite of soda (cryst.)	12 „	120 „
Water	100 „	1000 c. c

Solution B.

Carbonate of Potash	10 parts	100 grammes.
Water	100 „	1000 c. c.

For use mix one part of *A* with two parts of *B*.

II. For hard development:

Glycin	5 parts	50 grammes.
Carbonate of potash	25 „	250 „
Sulphite of soda (cryst.)	25 „	250 „
Water	100 „	1000 c. c.

For use to be diluted three times its volume.

GLYCIN-HAUFF.

The concentrated developer is made up as follows :—350 grains (80 grammes) of sodium sulphite crystal are dissolved by heat in one ounce (100 c. c.) of water, 150 grains (35 grammes) of glycin are then added, and the mixture is to be heated to boiling point, and one and a half ounces (150 grammes) of potash carbonate are added (begin adding the potash in small quantities, on account of the carbonic acid gas). When cold, this concentrated developer—forming a thin, pasty solution—may be kept as stock. For use, shake the solution first, and dilute the required quantity twelve times for ordinary purposes. For use when development is to be left to itself, the stock solution is diluted fifty times.

ILFORD SPECIAL RAPID PLATES

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EXTREME SPEED.
EXTREME EASE.
UNRIVALLED FOR SNAP-SHOTS.

ILFORD, LIMITED, ILFORD, LONDON, E.

A ONE-SOLUTION FORMULA.

Sodium sulphite........................	40 grains	23 grammes.
Glycin	20 ,,	11 ,,
Potassium carbonate	80 ,,	46 ,,
Water	4 ounces	1000 c. c.

PARAMIDOPHENOL.

Paramidophenol is the basis of rodinal and can be prepared either as a one or two-solution developer; the former when made with caustic alkalies is specially suitable for negative work, whilst the latter made with the carbonate alkalies is more suitable for positives.

Two-solution formula.

A.	Paramidophenol hydrochloride.	½ ounce	20 grammes.
	Potassium metabisulphite	¼ ,,	10 ,,
	Water	25 ounces	1000 c. c.
B.	Sodium sulphite.........................	1½ ounces	60 grammes.
	Potassium carbonate...............	1½ ,,	60 ,,
	Water	25 ,,	1000 c. c.

For use mix 1 part A with 2 parts B.

Single-solution:

Potassium metabisulphite	¾ ounce	30 grammes.
Distilled water	2½ ounces	100 c. c.
Paramidophenol	¼ ounce	10 grammes.

Stir the solution and add gradually

Saturated solution caustic soda *q.s.*

till the precipitate first formed is redissolved.

For use dilute with from 10 to 30 parts of water.

Para-amidophenol chlorhydrate ...	48 grains	5 grammes.
Crystallised carbonate of sodium...	1 oz.	50 ,,
Crystallised sulphite of sodium ...	1 oz.	50 ,,
Water	20 ozs.	1000 ,,

For use, dilute with an equal bulk of water.

Para-amidophenol hydrochlorate	60 grains	7 grammes.
Sodium sulphite	60 ,,	7 ,,
,, carbonate	400 ,,	46 ,,
Water..	20 ounces	1000 c.c.

ILFORD CHROMATIC PLATES

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UNIQUE IN THEIR CORRECT RENDERING
OF COLOUR-VALUES IN MONOCHROME.

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DR. ANDRESEN'S FORMULA.

Para-amidophenol chlorhydrate	77 grains	8 grammes.
Sodium sulphite	768 „	80 „
„ carbonate	384 „	40 „
Water	20 ozs.	1000 c.c.

PYROCATECHIN.

A.	Pyrocatechin	192 grains	20 grammes.
	Sodium sulphite	1½ ounces	80 „
	Distilled water	20 „	1000 c.c.
B.	Potassium carbonate	2 ounces	100 grammes.
	Distilled water	18 „	1000 c.c.

For use, mix 1 part of A with 2 parts of B.

Another formula containing sufficient phosphate and caustic soda to form sodium tribasic phosphate, is the following:—

A.	Pyrocatechin	192 grains	20 grammes.
	Sodium sulphite	4 ounces	100 „
	Distilled water	20 „	1000 c. c.
B.	Sodium phosphate	450 grains	47 grammes.
	Caustic soda	48 „	4 „
	Distilled water	20 „	1000 c. c.

For use mix 1 part A, 1 part B, and 1 part water.

AMIDOL.

Amidol	80 grains	23 grammes.
Sodium sulphite	800 „	230 „
Water	8 ounces	1000 c. c.

For use, one ounce of the solution is diluted with three ounces of water, with one and a half grains of potassium bromide to the ounce of developer.

EIKONOGEN.

No. 1.	A.	Crystalline sulphite of soda	384 grains	40 grammes.
		Eikonogen	125 „	13 „
		Distilled water	10 ozs.	500 c. c.
	B.	Carbonate of potash (or calcined soda)	1¼-1½ oz.	60 to 75 grammes.
		Distilled water	10 ozs.	500 c. c.

For use, mix equal volumes of A and B.

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WORK.

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ONE-SOLUTION DEVELOPER.

Sulphite of soda in crystals......	8 ounces	100 grammes.
Carbonate of soda in crystals...	3 ,,	38 ,,
Distilled water	80 ,,	1000 c. c
Eikonogen	1 ounce	13 grammes.

HYDROQUINONE.

No. 1.		Hydroquinone	1 part	15 grammes.
		Sulphite of soda	2 parts	30 ,,
		Carbonate of soda............	10 ,,	150 ,,
		Water	67 ,,	1000 c. c.
No. 2.	A.	Hydroquinone	4 grains	9 grammes.
		Metabisulphite of potash...	4 ,,	9 ,,
		Bromide of potassium	1 grain	23 ,,
		Distilled water	1 ounce	1000 c. c.
	B.	Potassium hydrate	10 grains	23 grammes.
		Distilled water	1 ounce	1000 c. c.

Equal parts of A and B.

With some plates the bromide may be omitted.

No. 3.	A.	Hydroquinone.................	80 grains	9 grammes.
		Citric acid	10 ,,	1·4 ,,
		Sulphite of soda (recrystal.)	80 ,,	9 ,,
		Distilled water	20 ounces	1000 c. c.
	B.	Caustic potash (fused)......	160 grains	18 grammes.
		Sulphite of soda	160 ,,	18 ,,
		Distilled water	20 ounces	1000 c. c.
	C.	Bromide of potassium	24 grains	55 grammes.
		Distilled water	1 ounce	1000 c. c.
	D.	Caustic potash	160 grains	18 gramme
		Distilled water	20 ounces	1000 c. c.

For normal exposures use equal parts of A and B, adding five minims of C for every ounce of solution, or one per cent. of C.

For over-exposed plates use D instead of B, with an extra quantity of C.

For under-exposed plates omit C, and in extreme cases add six or eight grains more of sulphite of soda to each ounce of the developer. The object of increasing or decreasing the quantity of sulphite is to give greater or lesser density.

ILFORD "Special" and "Alpha" LANTERN PLATES

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BRILLIANT SLIDES—"Special" for Cold Tones;
"Alpha" for a Wide Range of Warm Tones.
The "Alpha" Lantern Plate is the ONLY Plate of its kind.

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No. 4.	A.	Hydroquinone	160 grains	18 grammes.
		Sulphite of soda	2 ounces	100 ,,
		Citric acid	60 grains	7 ,,
		Bromide of ammonium	20 ,,	2 ,,
		Water to	20 ounces	1000 c. c.
	B.	Carbonate of potash	2 ounces	100 grammes.
		Carbonate of soda (crystal)	2 ,,	100 ,,
		Water to	20 ,,	1000 c. c.

Take equal parts.

No. 5.	A.	Hydroquinone	15 grains	7 grammes.
		Sulphite of soda	75 ,,	35 ,,
		Water	5 ounces	1000 c.c.
	B.	Carbonate of potash	90 grains	41 grammes.
		Water	5 ounces	1000 c.c.

C. Ten per cent. solution of bromide of potassium.

Use equal parts of A and B, and add two or three minims of C. With some plates no bromide restrainer will be required.

No. 6.	Sulphite of soda	4 ounces	40 grammes.
	Hydroquinone	½ ounce	5 ,,
	Carbonate of soda	7½ ounces	75 ,,
	Water	20 ,,	200 c.c.

For use, dilute ten parts with water to thirty-five parts.

For a single stock solution prepare as follows :—

No. 7.	A.	Hydroquinone	50 grains	29 grammes.
		Metabisulphite of potash	80 ,,	46 ,,
		Water	4 ounces	1000 c.c.
	B.	Carbonate of potash	840 grains	480 grammes.
		Water	4 ounces	1000 c.c.

Filter solution B, and then mix A and B.

For use, take half an ounce of this solution and add to five ounces of water.

FOR CHLORIDE PLATES.

Hydroquinone	2 grains	4·5 grammes.
Sulphite of soda	10 ,,	23 ,,
Carbonate of ammonia (or pot.)	10 ,,	23 ,,
Bromide of potassium	⅒ grain	0·3 ,,
Water	1 ounce	1000 c.c.

ILFORD P.O.P.

THE LEADING GELATINO-CHLORIDE PRINTING-OUT PAPER.

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DIPHENAL.

Diphenal, one of the recently introduced new developers, is chemically di-amido-oxydiphenyl, and it is the production of the Actien-Gesellschaft für Anilin-fabrikation, of Berlin. It is sent out in the form of a readily prepared solution of a brown colour, and the following are the directions for its use. For correctly exposed plates take:—

Diphenal	1 part.
Water	15 to 20 parts.

For over-exposed plates—

Diphenal	1 part.
Water	8 to 10 parts.

and for under-exposed plates take—

Diphenal	1 part.
Water	20 to 25 parts.

ACETONE PYRO-DEVELOPER.

Messrs. Lumière, who introduced acetone as a substitute for alkali in the pyro-developer, recommend the following composition as the best for a normal developer:—

Water	100 parts.
Sulphite of sodium (anhydrous)	5 "
Acetone solution	10 "
Pyrogallic acid	1 part.

ORTOL.

1. Ortol Soda.

A.	Water, cold	10 ounces	1000	c. c.
	Metabisulphite of potash	35 grains	7·5	grammes.
	Ortol	70 "	15	"
B.	Water	10 ounces	1000	c. c.
	Carbonate of soda, crystals	1¼ "	120	grammes.
	Sulphite of sodium, crystals	1¾ "	180	"
	Bromide of potassium	5—10 grains	1—2	"
	Hypo solution, 5 : 100	50 minims	10	c. c.

2. Ortol Potash.

A.	Water, cold	10 ounces	1000	c. c.
	Metabisulphite of potash	35 grains	7·5	grammes.
	Ortol	70 "	15	"

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THE NEW
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Absolutely Simple and Reliable.

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Water	10 ounces	1000	c. c.
Carbonate of potash	½ ounce	60	grammes.
Sulphite of sodium, crystals	1¾ ounces	180	,,
Bromide of potassium	5—10 grains	1—2	,,
Hypo solution 5 : 100	50 minims	10	c. c.

In cold weather the bromide of potassium may be left out.
For quick development take 1 part A and 1 part B.
For slow and soft development take 1 part A, 1 part B, 1 part water.

ADUROL.

I.—SEPARATE DEVELOPER.

A.	Adurol	10 grammes	85 grains.
	Sulphite of sodium (cryst.)	80 ,,	1¾ ounces.
	Water	500 c. c.	10 ,,
B.	Carbonate of potash	60 grammes	1¼ ounces.
	Water	500 c. c.	10 ,,

For studio work and snap-shots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

II.—ONE-SOLUTION (CONCENTRATED) DEVELOPER.

Sulphite of sodium (cryst.)	200 grammes	4 ounces.
Carbonate of potash	150 ,,	3 ,,
Water	500 c. c.	10 ,,

After all having been dissolved,

Adurol	25 grammes	½ ounce.

For studio work and snap-shots take 1 part with 3 parts of water
For time exposures outdoor take 1 part with 5 parts of water.

KACHIN.

A SINGLE-SOLUTION DEVELOPER.

Water	20 ozs.	200 grammes.
Sulphite of soda	½ oz.	5 ,,
Carbonate of soda (crystals)	1 ,,	10 ,,
Kachin	96 grains	2 ,,

ILFORD BROMIDE PAPER

POPULAR PRICES.

SUPERB MATT SURFACE.
CONTACT OR ENLARGEMENT.
See Price List for Varieties.

ILFORD, LIMITED, ILFORD, LONDON, E.

A Two-solution Developer.

A. Water	20 ozs.	250 grammes.
Sulphite of soda	2 ,,	25 ,,
Kachin	192 grains	5 ,,
B. Water	20 ozs.	250 grammes.
Caustic soda (pure sticks)	192 grains	5 ,,
Phosphate of soda	3¾ ozs.	47 ,,

For use, mix 1 part of A with 1 part of B and 1 part of water.

IMOGEN-SULPHITE.

This new developing agent is said to be a mixture of well-known developers, and it is simple in use and works cleanly and with great brilliance.

A. Imogen-sulphite	1 ounce	83·3 grammes.
Warm distilled water	11 ounces	1000 c. c.

B. Cold saturated solution, sodium carbonate.

For correctly exposed plates mix 2 parts of A with 1 part of B. For under-exposure of soft negatives mix 2 parts A, 1 part B, and 2 parts water. For over-exposure add from 5 to 50 drops of 10 per cent. solution of potassium bromide to every ounce of the developer. For very heavy contrasts use equal parts of A and B, and add to every ounce of developer 5 drops of 10 per cent. solution of potassium bromide.

DIOGEN.

Diogen is one of the latest developing agents, the composition of which is a secret. It gives a negative with good black colour and good gradation.

Sodium sulphite	4 ounces	100 grammes.
Diogen	1 ounce	24 ,,
Distilled water	10 ounces	250 c. c.
Potassium carbonate	5 ,,	125 grammes.

For correct exposure mix :—

Concentrated solution	4 drachms	14 c. c.
Water	17 ,,	60 ,,
Potassium bromide 10 per cent. solution	2 drops	5 ,,

ILFORD PLATONA PAPER

POPULAR PRICES.

GENUINE PLATINUM PAPER.
In Two Varieties, Rough and Smooth.

ILFORD, LIMITED, ILFORD, LONDON, E.

For under-exposure:—

Concentrated solution ...	4 drachms	14 c. c.
Water	2–3 ounces	60-90 „

For over-exposure:—

Concentrated solution ...	4 drachms	14 c. c.
Water	1½–2 ounces	25-60 „
Potassium bromide 10 per cent. solution	2–85 m.	5-210 „

HYDROQUINONE, BR.

This developing agent is stated to be a chemical mixture of hydroquinone and a bromide, and whilst possessing all the advantages of hydroquinone, such as clear working, it does not give that harshness of contrast so characteristic of hydroquinone. It keeps well and does not stain.

A.	Hydroquinone Br....................	½ ounce	10 grammes.
	Sodium sulphite........................	4 ounces	80 „
	Water 25	„	500 c. c.
B.	Potassium carbonate...............	3 ounces	60 grammes.
	Water 25	„	500 c. c.

For use mix 5 parts A, 5 parts B, and 4 parts water.

For over-exposure mix equal parts of A and B, and 20 to 30 drops of 10 per cent. bromide solution per ounce. For under-exposure mix equal parts A and B, and from 2 to 3 times the quantity of water.

SYNTHOL.

ONE SOLUTION.

Synthol..................................	30 grains	8 grammes.
Sodium sulphite	150 „	40 „
Water	3½ ozs.	1000 c. c.

TWO SOLUTION.

1.	Synthol..................................	60 grains	12·5 grammes.
	Sodium metabisulphite..........	360 „	75 „
	Water	10 ozs.	1000 c. c.
2.	Carbonate of soda	1 oz.	100 grammes.
	Water	10 ozs.	1000 c. c.

For use mix in equal parts.

ILFORD FILMS
FOR ALL WHO TRAVEL.

POPULAR PRICES.

Easily worked in precisely the same way as
ILFORD PLATES.
See Price List for Varieties.

ILFORD, LIMITED, ILFORD, LONDON, E.

LUMIÈRE'S QUINOMET.

Quinomet is a chemical combination of Metol and Hydroquinone.

INSTRUCTIONS.

Normal Quinomet Developer.

Hot water	1,000	parts.
Quinomet	9	,,
Anhydrous soda sulphite	60	,,

Dissolve the Quinomet thoroughly in hot water and then add the soda sulphite.

If a more vigorous developer is required, add to the above formula either 10 parts of soda carbonate or 30 parts of acetone.

Lumière's Formosulphite may be most advantageously employed in conjuction with Quinomet and the following formula gives excellent results either with plates, films or papers and is strongly recommended

Hot water	1,000	parts.
Quinomet	9	,,
Formosulphite	60	,,

Plates, much under-exposed, will often produce good results if instead of carbonate of soda or acetone, an addition of 5 parts of caustic lithia be made to the normal developer.

Over exposure is best dealt with by the use of potassium bromide, a 10% solution of which may be added to the normal developer as required.

Quinomet is also very suitable for stand development and we give below a formula which gives very fine results when used in an upright bath. Time of development with this formula is about one hour.

For Stand Development.

Water	4,000	parts
Quinomet	5	,,
Anhydrous soda sulphite	50	,,
10 % solution of pot. bromide	5	,,

For the development of papers we recommend the following formula:

Water	1,000	parts
Quinomet	9	,,
Anhydrous soda sulphite	60	,,
,, soda carbonate	10	,,
10 % solution of pot. bromide	10	,,

ILFORD CAMERA

FORTY EXPOSURES WITHOUT RELOADING.

CAN BE FULLY LOADED
with Forty Ilford Quarter-Plate Flat Films
IN HALF A MINUTE.

ILFORD, LIMITED, ILFORD, LONDON, E.

LUMIÈRE'S FORMOSULPHITE (Patent).

Formosulphite is a new product, by the use of which in the preparation of developers both preservative (such as soda sulphite, metabisulphite, &c.) and alkaline constituents (as carbonate or caustic potash of soda) are advantageously replaced.

DIRECTIONS FOR USE.

Dissolve the Formosulphite in water, to which add the developing agent.

The following formulæ may be of assistance.

Pyrogallic Acid.	
Water	100 parts
Formosulphite	9 ,,
Pyrogallic Acid	1 ,,

Hydroquinone.	
Water	100 parts
Formosulphite	9 ,,
Hydroquinone	1 ,,

Paramidophenol.	
Water	100 parts
Formosulphite	14 ,,
Paramidophenol	1 ,,

Eikonogen.	
Water	100 parts
Formosulphite	9 ,,
Eikonogen	1½ ,,

Metol.	
Water	100 parts
Formosulphite	9 ,,
Metol	1 ,,

Pyrocatechin.	
Water	100 parts
Formosulphite	14 ,,
Pyrocatechin	1 ,,

Metol-Hydroquinone.	
Water	100 parts
Formosulphite	8 ,,
Metol	½ ,,
Hydroquinone	1 ,,

Hydramine.	
Water	100 parts
Formosulphite	7 ,,
Hydramine	½ ,,
10 % solution of pot. bromide	1 ,,

The above solutions may be prepared in a more concentrated form, if desired, and water added at time of use.

The developers prepared as above may be regulated in action by the use of a solution of pot. bromide, as ordinarily employed; or by alteration of the proportion of Formosulphite. For over-exposure decrease the quantity, and for under-exposure add more Formosulphite.

At ordinary temperatures water will dissolve 28 % of Formosulphite, and a solution may be made of

Water	100 parts
Formosulphite	28 ,,

which will keep indefinitely, and may be used in proportionate quantities.

THE GELATINO-CHLORIDE PROCESS.

BARKER'S FORMULA FOR PRINTING-OUT EMULSION.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	175 grains	80 grammes,
Chloride of ammonium	18 ,,	8 ,,
Rochelle salts	50 ,,	23 ,,
Nitrate of silver	75 ,,	31 ,,
Alcohol	4 drachms	100 c. c.
Water	5 ounces	1000 ,,

Heat to 100° Fahr. (38° C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

VALENTA'S FORMULA.

A.	Silver nitrate	480 grains	32 grammes.
	Citric acid	120 ,,	8 ,,
	Hot water	5¼ ounces	160 c. c.
B.	Gelatine	1440 grains	96 grammes.
	Ammonium chloride	42 ,,	2·8 ,,
	Water	24.3 ounces	700 ,,
C.	Tartaric acid	42 grains	2·8 grammes.
	Sodium bicarbonate	21 ,,	1·4 ,,
	Alum	27 ,,	1·8 ,,
	Water	5 ounces	140 c. c.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50° C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40° to 50° C, and then filter. For matt-surface papers the gelatine should be reduced to 754 grains or 80 grammes.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0·05 to 0·1 per cent. of calcium bichromate solution; this can be made by dissolving 480 grains or 25 grammes of pure chromic acid in 4 ounces or 100 c.c. of distilled water and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered and the filter washed with distilled water up to 4 ounces or 100 c.c.

BEADLE'S FORMULA.

Nelson's gelatine	340 grains	112 grammes.
Alum	15·5 „	5 „
Water	6¼ ounces	900 c.c.
Rochelle salt	15·5 grains	5 grammes.
Ammonium chloride	11 „	3·5 „

Heat to 50° C., and add :—

Silver nitrate	115 grains	37·5 grammes.
Citric acid	62 „	20 „
Water	1 ounce	100 c.c.

TONING BATHS FOR GELATINO-CHLORIDE PAPERS.

SULPHOCYANIDE BATH.

Chloride of gold	1 grain	0·25 grammes.
Ammonium or potassium sulphocyanide	12 grains	3·0 „
Water	8 ounces	1000 c.c.

It is necessary for this and all sulphocyanide baths to ripen; the best method of mixing is to boil the water and dissolve the gold in half and the sulphocyanide in the other half, and then pour the former into the latter, stirring all the time, and use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

CONCENTRATED SULPHOCYANIDE.

BUHLER'S FORMULA.

Distilled water	1 ounce	280 c.c.
Chloride of gold	8·5 grains	5 grammes.
„ „ strontium	85 „	50 „

Heat the water to 98° C., add the gold and then the strontrum, and add

Potassium sulphocyanide	25 grains	15 grammes.
Distilled water	7 drachms	250 c.c.

also heated to 98° C. When cool, filter, and wash the filter with distilled water so as to make the total bulk 2½ ounces or 700 c. c. For use mix 1 part of the stock solution with 19 parts of water.

THE FORMATE BATH.

Chloride of gold	1 grain	0·4 grammes.
Carbonate of soda	2 grains	0·8 „
Formate „ „	15 „	60·0 „
Water	5 ounces	1000 c. c.

The prints must be immersed in a 10 % solution of salt and water before using this bath.

COMBINED TONING AND FIXING BATH.

VALENTA'S.

Sodium hyposulphite	8 ounces	400 grammes.
Ammonium sulphocyanide	1 ounce	50 „
Nitrate of lead	175 grains	20 „
Alum	350 „	40 „
Water	20 ounces	1000 c. c.

Dissolve the hypo in the water, then add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 50° C. for ten minutes; allow to cool. For use take

Stock solution (as above)	100 parts.
Water	100 ,,
Chloride of gold (1 % solution)	8 ,,

Wash the prints well first.

ALKALINE TONING AND FIXING BATH.

Chloride of gold	2 grains	0·2 grammes.
Nitrate of lead	10 ,,	1 ,,
Chalk	¼ ounce	25 ,,
Hypo	4 ounces	200 ,,
Water	20 ,,	1000 c. c.

Shake the solution well and allow to settle, and use the clear portion.

PLATINUM BATHS FOR GELATINO-CHLORIDE PAPERS.

The prints must be immersed for five minutes in a 10 % solution of salt, and then rinsed prior to toning.

Potassium chloroplatinite	2 grains	2 grammes.
Dilute phosphoric acid	30 minims	30 c. c.
Distilled water	2¼ ounces	1000 ,,

HADDON'S FORMULA.

Platinum perchloride	3 grains	0·2 grammes.
Sodium formate	100 ,,	6·3 ,,
Formic acid	30 minims	1·2 c. c.
Water	35 ounces	1000 ,,

BLACK TONES ON GELATINO-CHLORIDE PRINTS.

VALENTA'S FORMULA.

Potassium chloroplatinite	2½—10 grains	·5—·1 gramme.
M-phenylendiamine	2½—10 ,,	·5—·1 ,,
Water	10 ounces	1000 c. c.

Wash the prints well first. Another method is to print deep and immerse the prints in

Salt	½ ounce	25 grammes.
Sodium bicarbonate	80 grains	5 ,,
Water	20 ounces	1000 c. c.

then wash well and tone in a borax gold bath to a purple red, then well wash and tone in the phosphoric platinum bath.

RED TONES ON GELATINO CHLORIDE.

VALENTA'S FORMULA.

Uranium nitrate	1 grain	1 gramme.
Thiosinnamine	5 grains	5 grammes.
Water	1 ounce	500 c. c.

The prints must be treated to a salt bath, well washed, and then toned.

THIOCARBAMIDE TONING BATH.

This bath is strongly recommended by Hélain and Valenta as a great improvement on the sulphocyanide bath.

Thiocarbamide	10 grains	1 gramme
Distilled water	½ ounce	25 c. c.

Dissolve. Add sufficient of this to

Chloride of gold	10 grains	1 gramme
Distilled water	2 ounces	100 c. c.

To redissolve the precipitate first formed, then add

Citric acid	5 grains	·5 gramme
Distilled water to	20 ounces	1,000 c. c.

And add

Salt	100 grains	10 grammes

The prints should be well washed before and after fixing.

THE COLLODIO-CHLORIDE PROCESS,

VALENTA'S FORMULA,

1.	Strontium chloride	154 grains	10 grammes.
	Lithium ,,	77 ,,	5 ,,
	Water	500 minims	30 c. c.
	Alcohol (absolute)	929 ,,	55 ,,
2.	Silver nitrate	400 grains	20 grammes,
	Water	500 minims	30 c. c.
	Alcohol	1013 ,,	60 ,,
3.	Citric acid	77 grains	5 grammes.
	Alcohol	675 minims	40 c. c.
	Glycerine	92 grains	6 grammes.

In a bottle capable of holding 1000 parts pour 350 parts of 3% collodion and add gradually 15 parts of No. 1, then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after each addition; then add 50 parts of No. 3, and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0·1 to 0·4 % calcium chromate solution is added. By reducing the amount of pyroxyline in the above formula the emulsion is more suitable for matt surface paper.

THE ALBUMEN PROCESS.

PRESERVATIVES FOR SENSITISED ALBUMEN PAPER.

1.—Sensitise the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of

Citric acid	1 ounce	33 grammes.
Water	30 ounces	1000 c.c.

Or,

2.—Sensitise as usual, drain well, and wash the paper in three or four changes of water, then float the back on a solution of

Nitrite of potassium	5 ounces	50 grammes.
Water	100 „	1000 c.c.

When dry, roll the paper up, coated side out, and wrap in blotting-paper soaked in the nitrite of potash solution, and dried.

TONING FORMULÆ FOR ALBUMEN PRINTS.

No. 1.	Chloride of gold	1 grain	0·3 grammes.
	Acetate of soda	30 grains	9 „
	Water	8 ounces	1000 c. c.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2.	Chloride of gold	1 grain	0·3 grammes.
	Bicarbonate of soda	4 grains	1 gramme.
	Water	8 ounces	1000 c. c.

This is ready for immediate use after preparation, but it will not keep

No. 3.	Chloride of gold	1 grain	0·3 grammes,
	Phosphate of soda	20 grains	6 „
	Water	8 ounces	1000 c. c.

This gives rich tones of a deep purple nature, but must be used soon after preparation.

No. 4.	Gold solution	10 drachms	63 c. c.
	Acetate of lime	20 grains	2 grammes.
	Chloride of lime	1 grain	0·1 „
	Tepid water	20 ounces	1000 c. c.

The 'gold solution' before mentioned is prepared by neutralising as much as is required of a one-grain solution of chloride of gold by shaking it up with a little prepared chalk, then allowing it to settle, and filtering off the clear liquid. This toning bath improves by keeping. To use, add two ounces of it to eight ounces of tepid water, which wil prove sufficient to tone a full-sized sheet of paper.

No. 5.	Chloride of gold	15 grains	7 grammes.
	Water	5 ounces	1000 c. c.

Neutralise with lime water, make up to fifteen ounces (3000 c. c.) with water, and add two drachms (54 grammes) of chloride of calcium. This stock solution will keep for a long time for use. Dilute one ounce with ten ounces of water.

TONING AND FIXING IN ONE BATH.

No. 6.	Chloride of gold	1 grain	1 gramme.
	Phosphate of soda	15 grains	17 grammes.
	Sulphocyanide of ammonium	25 ,,	28 ,,
	Hyposulphite of soda	240 ,,	275 ,,
	Water	2 ounces	1000 c.c.

Dissolve the gold separately in a small quantity of water, and add to the other solution.

INGALL'S TONING FORMULA.

Hard water (fluid)	20 ounces	1000 c.c.
Bi-carbonate of potash	20 grains	2 grammes.
Gold	2 ,,	0·2 ,,

FERRO-PRUSSIATE OR BLUE PRINTING.

	Ammonio-citrate of iron (brown)	60 grains	15 grammes.
	Distilled water	½ ounce	60 c.c.
	Potassium ferridcyanide	32 grains	8 grammes.
	Distilled water	160 minims	40 c.c.
	Oxalic acid	2 grains	0·5 grammes.
or	Ammonio-citrate of iron (green)	50 grains	12·5 grammes.
	Distilled water	¼ ounce	30 c. c.
	Potassium ferridcyanide	18 grains	4·5 grammes.
	Distilled water	¼ ounce	30 c. c.

Dissolve the salts separately, and mix just before use; filter if necessary. The latter formula gives a much more sensitive paper.

PELLET'S PROCESS.

This process may be described as the antithesis of the ferro-prussiate. Whereas in the latter the action of light gives a blue image, in Pellet's process those portions protected from light are blue.

HANGK'S FORMULA.

1.	Gum arabic	96 grains	20 grammes.
	Distilled water	1 ounce	100 c. c.
2.	Ammonio-oxalate of iron	278 grains	60 grammes.
	Distilled water	1 ounce	100 c. c.
3.	Ferric chloride	½ „	50 grammes.
	Distilled water	1 „	100 c. c.

For use mix No. 1, 35 parts: No. 2, 10 parts; No. 3, 3 parts.

WATERHOUSE'S FORMULA.

1.	Gum arabic	1 ounce	170 grammes.
	Distilled water	4 ounces	650 c. c.
2.	Tartaric acid	100 grains	40 grammes.
	Distilled water	¾ ounce	150 c. c.
3.	Ferric chloride solution (Sp. Gr. 1·453)	5 drachms	120 c. c.

Mix the gum and acid and then add the iron solution, allow to stand 24 hours and add sufficient water to make the specific gravity 1·100.

After printing the paper should be floated on a 20% solution of ferrocyanide of potash.

SEPIA PAPER (LARUS'S FORMULA.)

1.	Ammonio-citrate of iron (green)	84 grains	35 grammes.
	Tartaric acid	9·6 „	4 „
	Distilled water	1 ounce	200 c. c.
2.	Gelatine	14·5 grains	6 grammes.
	Distilled water	½ ounce	100 c. c.
3.	Silver nitrate	24 grains	10 grammes.
	Distilled water	½ ounce	100 c. c.

Mix Nos. 1 and 2 at 35° C. and gradually add with constant stirring No. 3. The solution should be applied warm to the paper. After printing immerse in water and then fix in 1·50 hypo solution. The action of light produces a brown image.

FERRO-GALLIC PROCESS.

(Sometimes known as the "ink" or Colas's process).

EDER'S FORMULA.

Ferric chloride	192 grains	10 grammes.
Ferric sulphate	96 „	5 „
Tartaric acid	172 „	9 „
Distilled water	4 ounces	100 c. c.
Dissolve and add		
Gelatine	96 grains	5 grammes.
Distilled water	2 ounces	50 c. c.

The gelatine must be dissolved before the iron salts are added.

NAKHARA'S FORMULA.

Gum arabic	288 grains	15 grammes.
Warm water	4½ ounces	110 c. c.

When dissolved add the following in the order given :—

Tartaric acid	38 grains	2 grammes.
Salt	172 „	9 „
Ferric sulphate	192 „	10 „
Ferric chloride	288 „	15 „

The paper must be quickly dried in the dark.

DEVELOPER FOR ABOVE.

Oxalic acid	9½ grains	1 gramme.
Gallic acid	58 „	6 grammes.
Water	20 ounces	1000 c. c.

URANIUM PRINTING.

A 1 to 6 solution of uranium nitrate may be merely painted over well sized paper and dried, but better results are obtained with the following :—

Uranium nitrate	80 grains	20 grammes.
Starch	20 „	5 „
Acetic acid	A few drops.	
Water	1 ounce	120 c. c.

The starch should be boiled till quite clear, the acid added, and then the uranium. After printing the print should be rinsed in water, and floated on one or more of the following solutions :—

For red prints : 5% solution potassium ferridcyanide, acidulated with nitric acid. By treating the print thus obtained with a 4% solution of ferrous sulphate, acidulated with sulphuric acid, greenish-blue prints will result ; if a 1·50 cobalt nitrate solution, bright green tones are obtained. By painting the red uranium print with 0·5% solution of chloride of gold violet tones are given, and if silver nitrate solution is used greyish black tones are given.

NEGATIVE INTENSIFIERS.

MONCKHOVEN'S.

1. A. Bromide of potassium	10 grains	23 grammes.
Bichloride of mercury	10 „	23 „
Water	1 ounce	1000 c.c.
B. Pure cyanide of potassium	10 grains	23 grammes.
Nitrate of silver	10 „	23 „
Water	1 ounce	1000 c.c.

Place the negative in A till it is white, then rinse and transfer it to solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

MERCURY AND AMMONIA.

Pour over the negative a saturated solution of mercuric chloride (bichloride of mercury); do not keep it on too long, unless the negative is very thin. Wash well, and immerse in bath of—

Water	10 ounces	1000 c.c.
Ammonia	10 minims	21 „

Leave the plate in this solution until the black colour goes quite through the film.

MERCURY WITH SODIUM SULPHITE.

Whiten the negative in the saturated solution of mercuric chloride, wash and blacken with a solution of sulphite of sodium 1 in 5.

IODIDE OF MERCURY.

Dissolve one drachm (14 grammes) of bichloride of mercury in seven ounces (700 c. c.) of water, and three drachms (42 grammes) of iodide of potassium in three ounces (300 c. c.) of water, and pour the iodide solution into the mercury till the red precipitate formed is completely dissolved.

For use, dilute with water, flow over the negative till the proper density is reached, and wash, when the deposit will turn yellow. Remove the yellow colour by flowing a five per cent. solution of hypo over the plate, and give it the final washing.

URANIUM.

Uranium nitrate	12 grains	7 grammes.
Potassium ferricyanide	15 „	9 „
Water (fluid)	4 ounces	1000 c. c.

Before using this intensifier, great care is necessary that every trace of hypo is dissolved from the film, or red fog will result.

FERRICYANIDE OF LEAD.

The negative, after washing, is placed in a solution made as follows:—

Lead nitrate	20 grains	46 grammes.
Ferricyanide of potassium	30 „	69 „
Distilled water	1 ounce	1000 c. c.

After this it is again thoroughly washed until the drainings from the plate give a scarcely perceptible blue colour with ferrous-sulphate solution, and then ammonium sulphide (one part to ten parts of water) is poured over it.

BROMIDE OF COPPER.

A.	Potassium bromide	180 grains	41 grammes.
	Water	10 ounces	1000 c. c.
B.	Cupric sulphate	240 grains	55 grammes.
	Water	10 ounces	1000 c. c.

Mix the solutions, and, after standing a few hours, decant or filter out any potassium sulphate that may be precipitated. The solution will keep indefinitely, and may be used over and over again.

The *modus operandi* of intensification is the same as with the mercuric salt. The darkening or rendering sufficiently opaque of the deposit can be done by a solution of ammonia in water—say, water, 10 ounces; stronger solution of ammonia, 1 drachm. The application of any old developer will bring about the same result.

LUMIÈRE'S MERCURIC IODIDE INTENSIFIER.

Composition of Normal Intensifier.

Water	100 parts.
Anhydrous sulphite of soda	10 ,,
Mercuric iodide	1 part.

Instructions for Use.—Dissolve the anhydrous sulphite of soda in the water, then add the mercuric iodide. After intensification in the above solution, the image is washed and then treated with an alkaline developer, such as is used for ordinary negative work.

NEGATIVE REDUCERS.

FARMER'S.

Saturated solution of ferridcyanide of potassium	1 part	100 c. c.
Hyposulphite of soda solution, 1 : 5	10 parts	1000 ,,

BELITZSKI'S.

Potassium ferric oxalate	154 grains	10 grammes
Sodium sulphite	308 ,,	20 ,,
Water	7 ounces	200 c. c.

Dissolve and add

Oxalic acid (crystals) ...... 38-45 grains or 2·5 to 3 grammes

and shake till the solution turns green, then decant from any undissolved crystals and add

Hyposulphite of soda	1½ ounces	50 grammes.

NAMIAS' POTASSIUM PERMANGANATE.

Potassium permanganate	8 grains	0·5 gramme.
Water	35 ounces	1000 c. c.

Bathe the negative in this, and if it turns brown immerse in a 1 per cent. solution of oxalic acid, and wash and dry.

CYANIDE REDUCING SOLUTION.

Cyanide of potassium	20 grains	5 grammes.
Iodide of potassium	10 ,,	2 ,,
Bichloride of mercury	10 ,,	2 ,,
Water	10 ounces	1000 c. c.

Reduction takes place slowly and is easy to control. After reducing the negative should be washed thoroughly.

Perchloride of iron	30 grains	3·4 grammes.
Citric acid	60 ,,	6·8 ,,
Water	1 pint	1000 c. c.

ORTHOCHROMATIC PROCESSES.

SENSITISERS FOR BLUE GREEN AND GREEN.

Chrysaniline (sat. sol. in hot alcohol) ...	10 minims	2 c. c.
Distilled water	1 ounce	100 ,,

This reduces the sensitiveness slightly to blue violet and ultra violet, but sensitises close up to the D line through the green and greenish blue. Time of bathing, 2 to 3 minutes.

Acridine yellow (sat. sol. in hot alcohol)	150-250 minims	30·50 c. c.
Distilled water	1 ounce	100 ,,

This gives greater sensitiveness, which extends from D ½ E to ultra violet. Unfortunately the gelatine is rather deeply stained, and this can only be removed by alcohol.

Acridine orange N O (Leonhardt's) and benzoflavin II. (Oehler's) also sensitise well, the former up to D, the latter to E only.

SENSITISERS FOR GREENISH YELLOW AND YELLOW.

PRELIMINARY BATH.

Ammonia	10 minims	2 c. c.
Distilled water	1 ounce	100 ,,

Bathe the plates in this for two minutes, then immerse for the same time in

Erythrosine solution (1·500)	30 minims	6 c. c.
Ammonia	10 ,,	2 ,,
Water	1 ounce	100 ,,

and dry in the dark. Erythrosine is the best sensitiser for these colours. Naphthofluorescine (Bayer) is also useful, and does not lower the blue sensitiveness so much as erythrosine; a deeper coloured yellow screen is therefore required in practice. A preliminary bath is used as for erythrosine, and the sensitising bath is

Naphthofluorescine (1·500)	60 minims	12 c. c.
Ammonia	10 ,,	2 ,,
Distilled water	1 ounce	100 ,,

Bathe for two minutes and dry in the dark.

SENSITISERS FOR ORANGE AND RED.

DEBENHAM'S METHOD.

Bathe the plate in an alcoholic solution of Cyanine (1·2000) and dry in the dark; then bathe in distilled water for two or three minutes and expose while wet.

Much greater sensitiveness is given by Diazo black B H N, Benzon brown and Wool black 4 B and 6 B. With all these a deep gree filter must be used in the dark room. The method of using these dyes is as follows:—

For Diazo black and Benzonitrol brown.

PRELIMINARY BATH.

Ammonia	10 minims	2 c. c.
Alcohol	100 ,,	20 ,,
Water	1 ounce	100 ,,

Bathe the plates for two minutes, drain, and immerse for same time in

Dye solution (1·500)	250 minims	50 c. c.
Alcohol	1000 ,,	200 ,,
Ammonia	50 ,,	10 ,,
Water	7 ounces	700 ,,

For wool black 4 B or 6 B.

PRELIMINARY BATH.

Ammonia	10 minims	2 c. c.
Water	1 ounce	100 ,,

Bathe for two minutes, drain, and immerse for same time in

Dye solution (1·500)	25 minims	5 c. c.
Ammonia	5 ,,	1 ,,
Water	1 ounce	100 ,,

HYPO ELIMINATORS, CLEARING SOLUTIONS, &c.

TO RESTORE FADED NEGATIVES.

Mr. W. E. Debenham recommends the following solution for the purpose of restoring printing force to negatives which have faded after mercurial intensification:—

Schlippe's salt	10 grains	23 grammes.
Water	1 ounce	1000 c. c.

Wet the film thoroughly by soaking in a dish of water, and immerse in the restoring solution until the desired effect is obtained.

TO REMOVE THE LAST TRACES OF HYPO FROM THE FILM.

HYDROXYL.

Peroxide of hydrogen (twenty vols.)	1 drachm	25 c. c.
Water	5 ounces	1000 ,,

After washing the negative well it is immersed for a couple of minutes in the solution and again rinsed in water, when the intensification with silver can be at once proceeded with.

ANOTHER.

Where peroxide of hydrogen is not obtainable the following may be used as a substitute, the solution containing that substance in combination with others :—

Barium dioxide	1 ounce	250 grammes.
Glacial acetic acid	1 ,,	250 ,,
Water	4 ounces	1000 c. c.

Reduce the barium dioxide to a fine powder and add it gradually to the acid and water, shaking until dissolved. A few minutes' immersion in this solution will effectually remove or destroy the last traces of hypo.

Ammonium persulphate	2½ grains	5 grammes.
Carbonate of soda	5 ,,	10 ,,
Water	1 ounce	1000 c. c.

or

Potassium percarbonate	2½ grains	5 grammes.
Water	1 ounce	1000 c. c.

CLEARING SOLUTIONS.

Alum	2 ounces	200 grammes
Citric acid	1 ounce	100 ,,
Water	10 ounces	1000 c. c.

Wash moderately after fixing, and immerse the negative in the above.

ANOTHER.

Saturated solution of alum	20 ounces	1000 c. c.
Hydrochloric acid (commercial)	1 ounce	50 ,,

Immerse the negative after fixing, having previously washed it for two or three minutes under the tap; wash well after removal from the alum and acid.

NEGATIVE VARNISHES, FORMULÆ FOR.

No. 1.	Sandarac	4 ounces	143 grammes.
	Alcohol	28 ,,	1000 c. c.
	Oil of lavender	3 ,,	107 ,,

This is a good varnish for retouching upon, as a "tooth is easily obtained by rubbing."

No. 2.	White hard varnish	15 ounces	150 c.c.
	Methylated alcohol	20 to 30 ,,	200 to 300 c. c

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

Tough, hard, and durable:—

No. 3.	Bleached shellac	1¼ ounces	62 grammes.
	Mastic	¼ ounce	13 ,,
	Oil of turpentine	¼ ,,	13 c. c.
	Sandarac	1¼ ounces	62 grammes.
	Alcohol	20 fluid ounces	1000 c. c.

No. 4.	Sandarac	80 ounces	160 grammes.
	Turpentine	36 ,,	72 c. c.
	Oil of lavender	10 ,,	20 ,,
	Alcohol	500 ,,	1000 ,,

This one may be rubbed down with powdered resin, and gives a splendid surface for retouching:—

No. 5.	Sandarac	1 ounce	55 grammes.
	Seed lac	1½ ounces	85 ,,
	Castor oil	3 drachms	2 c. c.
	Oil of lavender	1½ ,,	1 ,,
	Alcohol	18 fluid ounces	1000 ,,

This varnish is somewhat dark in colour.

No. 6.	Best orange shellac	2½ ounces	125 grammes
	Oil of lavender or oil of turpentine	¼ ounce	13 c. c.
	Methylated alcohol	1 pint	1000 c. c.

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

No. 7.	Celluloid	5 grains	10 grammes.
	Amyl acetate	1 ounce	000 c. c.

This may be flowed over or applied with a brush to the negative and requires no heat.

Retouching Varnish.

Sandarac	1 ounce	167 grammes.
Castor oil	80 grains	31 ,,
Alcohol	6 ounces	1000 c. c.

First dissolve the sandarac in the alcohol, and then add the oil.

In the above formulæ the proportions of alcohol must be taken as approximate, as different samples of resins vary, some giving more viscous solutions than others.

Ground-glass Varnish.

Sandarac	90 grains	103 grammes.
Mastic	20 ,,	23 ,,
Ether	2 ounces	1000 c. c.

Dissolve the resins in the ether and afterwards add

Benzole ½ to 1½ ounces (250 to 750 c. c.).

The proportion of the benzole added determines the nature of the matt obtained.

THE WET-COLLODION PROCESS.

PYROXYLINE (Hardwich).

Sulphuric acid 1·845 (fluid)	18 ounces	600 c. c.
Nitric acid 1·457 ,,	6 ,,	200 ,,
Water (fluid)	5 to 5¼ ,,	167 to 182 c. c.
Cotton-wool	300 grains	23 grammes.

Temperature 150° Fahr. (60° C.) Time of immersion, 10 minutes

IODISED COLLODION (for Negatives).

For Acid Pyro Developer.

Ether, s.g. ·725	10 fluid ounces	1000 c. c.
Alcohol, s.g. ·805	4 ,,	400 ,,
Pyroxyline	120 grains	27 grammes.
Iodide of ammonium	30 ,,	7 ,,
,, cadmium	45 ,,	10 ,,
Alcohol ·830	4 fluid ounces	400 c. c.

BROMO-IODISED COLLODION (for Negatives).

Iron Developer.

Ether, s.g. ·725	10 fluid ounces	1000 c. c.
Alcohol, s.g. ·805	5 ,,	500 ,,
Pyroxyline	120 grains	27 grammes.
Iodide of Ammonium	40 ,,	9 ,,
,, cadmium	40 ,,	9 ,,
Bromide of ,,	20 ,,	4·5 ,,
Alcohol ·830	5 fluid ounces	500 c. c.

BROMO-IODISED COLLODION (for Positives or Ferrotypes).

Ether, s.g. ·725	10 fluid ounces	1000 c.c.
Alcohol, s.g. ·805	5 ,,	500 ,,
Pyroxyline	100 grains	23 grammes.
Iodide of cadmium	50 ,,	11½ ,,
Bromide of ammonium	25 ,,	5·7 ,,
Alcohol ·830	5 fluid ounces	500 c.c.

Note.—The iodides should be dissolved in the weaker spirit and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

The Nitrate Bath (for Negatives).

Nitrate of silver (recrystallised)	6 ounces	75 grammes.
Distilled water	80 fluid ounces	1000 c.c.
Nitric acid (pure)	8 minims	0·2 ,,

Saturate with iodide of silver, then filter.

This is best done by coating a plate with collodion and leaving it in the bath for some hours.

(For Positives or Ferrotypes).

Nitrate of silver (recrystallised)	5½ ounces	70 grammes.
Distilled water	80 fluid ounces	1000 c.c.
Nitric acid (pure)	½ drachm	0·8 ,,

Saturate with iodide of silver and filter as above.

Eder's Formula.

(For half-tone screen work).

Cadmium iodide	108 grains	7 grammes.
Ammonium iodide	50 ,,	3·2 ,,
,, bromide	18½ ,,	1·2 ,,
Alcohol	6 ounces	175 c. c.
Raw Collodion 2%	18 ,,	525 ,,

Or equal parts of above and

Strontium iodide	154 grains	10 grammes.
Cadmium bromide	68 ,,	1·8 ,,
Alcohol	7 ounces	200 c. c.
Collodion 2%	21 ,,	600 ,,

The developer specially recommended for above is:—

Sulphate of iron	288 grains	30 grammes.
,, ,, copper	192 ,,	16 ,,
Glacial acetic acid	1 ounce	50 c. c.
Alcohol	½ ,,	30 ,,
Water	20 ounces	1000 ,,

DEVELOPER.

For Negatives.

No. 1.	Ferrous sulphate	½ ounce	50 grammes.
	Glacial acetic acid	½ ,,	50 c.c.
	Alcohol	½ ,,	50 ,,
	Water	10 ounces	1000 ,,
No. 2.	Ammonio-sulphate of iron	75 grains	43 grammes
	Glacial acetic acid	75 ,,	43 ,,
	Sulphate of copper	7 ,,	4 ,,
	Water	4 ounces	1000 c.c.
	Alcohol	¼ ounce	60

FOR COLLODION POSITIVES OR FERROTYPES.

Ferrous sulphate	150 grains	34 grammes.
Glacial acetic acid	½ ounce	50 c. c.
Nitric acid..........................	5 minims	1 "
Alcohol	½ ounce	50 "
Water.................................	10 ounces	1000 "

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

NITRATE OF IRON DEVELOPER FOR POSITIVES.

Ferrous sulphate..................	1½ ounces	75 grammes.
Nitrate of baryta	1 ounce	50 "
Water	1 pint	1000 c. c.
Alcohol	1 ounce	50 "
Nitric acid	40 drops	4 "

The insoluble sulphate of baryta which is formed must be filtered out.

FIXING SOLUTION FOR POSITIVES.

Cyanide of potassium ...... ½	ounce	25 to 30 grammes.
Water .... 15 to 20	ounces	1000 c. c.

FOR COLLODION TRANSFERS.

Pyrogallic acid	5 grains	11 grammes.
Citric acid	3 "	7 "
Acetic acid	20 minims	41 c. c.
Water	1 ounce	1000 "
Alcohol	20 minims	41 "

PYROXYLINE FOR DRY-COLLODION PROCESSES.

FOR COLLODIO-BROMIDE OR UNWASHED EMULSION.

Nitric acid, s.g. 1·45............	2 fluid ounces	285 c. c.
Sulphuric acid, s.g. 1·845 ...	4 "	570 "
Water	1 fluid ounce	145 "
Cotton (cleaned and carded)	100 grains	33 grammes.
Temperature	150° Fahr.	65° C.
Time of immersion	10 minutes.	

FOR WASHED EMULSION.

Nitric acid, s.g. 1·45	2 fluid ounces	400 c. c.
Sulphuric acid, s.g. 1·845 ...	3 "	600 "
White blotting-paper	145 grains	66 grammes.
Temperature	100° Fahr.	38° C
Time of immersion	30 minutes.	

THE COLLODIO-BROMIDE PROCESS.

COLLODIO-BROMIDE EMULSION.

Ether, s.g. ·720	5 fluid ounces	620 c. c.
Alcohol, s.g. ·820	3 ,,	380 ,,
Pyroxyline	50 grains	14·3 grammes.
Bromide of cadmium and ammonium	80 ,,	23 ,,
or Bromide of zinc	76 ,,	21·5 ,,

Sensitise by adding to each ounce fifteen grains of nitrate of silve dissolved in a few drops of water and one drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

WASHED EMULSION (for Landscapes),
No. 1.

Ether, s.g. ·720	4 fluid ounces	590 c c.
Alcohol, s.g. ·820	2¾ ,,	410 ,,
Pyroxyline	40 grains	13·5 grammes.
Castile soap (dissolved in alcohol)	30 ,,	10 ,,
Bromide of ammonium and cadmium	84 ,,	27·3 ,,

Sensitise with one hundred grains of nitrate of silver dissolved in one ounce of boiling alcohol; and, after standing ten days, add a further twenty grains of silver dissolved as before in two drachms of alcohol

No. 2 (rapid).

Ether, s.g. ·720	4 fluid ounces	615 c.c.
Alcohol, s.g. ·820	2½ ,,	215 ,,
Pyroxyline	40 grains	14 grammes.
Castile soap	30 ,,	10·5 ,,
Bromide of ammonium and cadmium	56 ,,	20 ,,

Sensitise with 125 grains of nitrate of silver, dissolved, as before, in one ounce of alcohol with the aid of heat. In twelve hours' time add thirty grains more of the double bromide of ammonium and cadmium dissolved in half an ounce of alcohol.

FOR WASHED EMULSION (for Transparencies).

Ether, s g. ·720	5 fluid ounces	620 c.c.
Alcohol, s.g. ·820	3 ,,	380 ,,
Pyroxyline or papyroxyline	60 grains	17 grammes.
Bromide of cadmium and ammonium	100 ,,	29 ,,
or Bromide of zinc	96 ,,	27·5 ,,
Hydrochloric acid, s.g. 1·2	8 minims	2 c.c.

Sensitise with twenty grains of nitrate of silver to each ounce (4·3 grammes to each 100 c.c.), dissolved in a minimum of water with two drachms (13 c.c.) of boiling alcohol. Allow to stand for two or three days.

N. B.—In the three last formulæ, the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed, to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from twenty to twenty-four grains to the ounce of solvents.

DEVELOPING SOLUTIONS FOR COLLODION EMULSION.

Solution A.

Pyrogallic acid..............	96 grains	22 grammes.
Alcohol	1 fluid ounce	100 c.c.

Solution B.

Bromide of potassium ...	10 grains	23 grammes.
Water	1 fluid ounce	1000 c.c.

Solution C.

Liquor ammoniæ, s.g. ·880	1 fluid drachm	60 c.c.
Water	15 fluid drachms	940 ,,

or D.

Carbonate of ammonium	120 grains	275 grammes.
Water	1 fluid ounce	1000 c. c.

For each drachm (100 c. c.) of developer take, for a normal exposure five minims (8½ c. c.) of A, one or two minims (about 3 c. c.) of B, and the same of C; or, if D be used, add the above quantities of A, B, and C, to one drachm (100 c. c.) of D. When the details of the image are out, add double the quantities of B and C.

WELLINGTON'S COLLODIO-BROMIDE EMULSION FORMULÆ.

Pyroxyline	30 grains	23 grammes.
Ether	12 drachms	500 c. c.
Alcohol	12 ,,	500 ,,

To bromise, add 30 grains (23 grammes) bromide ammonium dissolved in 45 minims (31 c. c.) water, to which 4 drachms (170 c. c) of alcohol are afterwards added; 50 grains (33 grammes) of nitrate of silver dissolved in a drachm (4½ c. c.) of water are then added. After washing and drying, the pellicle is dissolved in 1¾ ounces (580 c. c.) of ether and the same of alcohol.

Developer.

No. 1.	Pyrogallic acid	1 ounce	56 grammes.
	Sulphite of soda	4 ounces	224 ,,
	Water	18 ,,	1000 c. c.
No. 2.	Potassium carbonate	3 ounces	166 grammes.
	Sulphite of soda	2 ,,	112 ,,
	Water	18 ,,	1000 c. c.
No. 3.	Bromide ammonium.........	1 ounce	100 grammes.
	Water	10 ounces	1000 c. c.

Use equal parts of each without dilution

NESBIT'S FORMULÆ.

Pyroxyline	60 grains	27·5 grammes.
Methylated alcohol	$2\frac{3}{4}$ ounces	550 c. c.
Ether	$2\frac{1}{4}$,,	450 ,,
Bromide ammonium (in water 100 minims, 200 c.c.)	63 grains	28 grammes.
Alcohol	1 ounce	200 c. c.
Nitrate of silver	100 grains	46 grammes.
Water	60 minims	25 c. c.

After washing and drying, redissolve in alcohol 4 ounces, ether ounces (800 c c.).

INTENSIFYING SOLUTIONS FOR COLLODION EMULSION.

Nitrate of silver	60 grains	68 grammes.
Citric acid	30 ,,	31 ,,
Nitric acid	30 minims	31 c. c.
Water	2 ounces	1000 ,,

To each drachm of a three-grain solution of pyrogallic acid add two or three minims of the above, and apply until sufficient density is attained.

MISCELLANEOUS FORMULÆ.

THE "DUSTING-ON" PROCESS.

No. 1.	Saturated solution of bichromate of ammonium	5 drachms or grammes.
	Honey	3 ,, ,, ,,
	Albumen	3 ,, ,, ,,
	Distilled water	20 to 30 ,, ,, c. c.
No. 2.	Dextrine	$\frac{1}{2}$ ounce or 5 grammes.
	Grape sugar	$\frac{1}{2}$,, ,, ,,
	Bichromate	$\frac{1}{2}$,, ,, ,,
	Water	$\frac{1}{2}$ pint = 10 ounces or 100 c. c.
No. 3.	Gum arabic	6 parts or grammes.
	Bichromate of potash	2.5 ,, ,, ,,
	Grape sugar	4 ,, ,, ,,
	Water	72 ,, ,, c. c.

SILVERING MIRRORS (MARTIN'S METHOD).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.*)

A.	Nitrate of silver	175 grains	40 grammes.
	Distilled water	10 ounces	1000 c. c.

B.	Nitrate of ammonium	262 grains	60 grammes.
	Distilled water	10 ounces	1000 c. c.
C.	*Pure* caustic potash	1 ounce	100 grammes.
	Distilled water	10 ounces	1000 ,,
D.	Pure sugar candy	½ ounce (avoird.)	100 grammes.
	Distilled water	5 ounces	1000 c. c.

Dissolve and add—

Tartaric acid	50 grains	23 grammes.

Boil in a flask for ten minutes, and when cool add—

Alcohol	1 ounce	200 c. c.

Distilled water *quant. suff.* to make up to 10 ounces or 2000 c. c.

For use take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downward in the solution.

INK FOR RUBBER STAMPS.

Aniline red (violet)	90 grains	206 grammes.
Boiling distilled water	1 ounce	1000 c. c.
Glycerine	half a teaspoonful	60 ,,
Treacle	half as much as glycerine	30 ,,

TO RECOVER FOGGED PLATES.

Make a solution as follows:—

Chromic acid	30 grains	7 grammes.
Bromide of potassium	60 ,,	14 ,,
Water	10 ounces	1000 c. c.

And immerse the plates for five minutes. Afterwards wash very thoroughly, and rear up to dry.

Or, instead of the above, make the following:—

Bichromate of potash	1 ounce	100 grammes.
Hydrobromic acid	2 drachms	25 ,,
Water	10 ounces	1000 c. c.

If hydrobromic cannot be obtained, use hydrochloric acid or a soluble bromide; in the last case a few drops of sulphuric acid being added to the solution. Use as before.

SOLUTION FOR MOUNTING PRINTS WITHOUT THEIR COCKLING.

Nelson's No. 1 photo. gelatine	4 ounces	182 grammes.
Water	16 ,,	728 c. c.
Glycerine	1 ounce	45 ,,
Methylated alcohol	5 ounces	227 ,,

Dissolve the gelatine in the water, then add the glycerine, and lastly the spirit.

ENCAUSTIC PASTE.

Pure wax	500 parts	grammes.
Gum elemi	10 ,,	,,
Benzole	200 ,,	c.c.
Essence of lavender	300 ,,	,,
Oil of spike	15 ,,	,,

BACKING SHEETS FOR DRY PLATES.

Gelatine	1 part	50 grammes.
Water	2 parts	100 c.c.
Glycerine	1 part	50 ,,
Indian ink	A small addition.	

Make a paste, and coat strong paper; place the prepared material, face downwards, on waxed glass to set. Press to back of plate before putting into dark slide.

SENSITISING SOLUTION FOR CARBON TISSUE.

Bichromate of potash	1 ounce	350 to 500 grammes
Water	20 to 30 ounces	1000 c.c.
Liquor ammoniæ	20 minims	1·5 to 2 c.c.

A strong solution should be used for hard negatives and a more dilute one for soft negatives.

WAXING SOLUTION

For Carbon Prints, or for Removing Collodion Films.

No. 1. Beeswax	20 grains	10 grammes.
Benzole rect. No. 1	4 ounces	1000 c.c.

For Flexible Supports (Autotype).

No. 2. Yellow resin	3 drachms	41 grammes.
Yellow beeswax	1 drachm	14 ,,
Rectified spirits of turpentine	10 ounces	1000 c.c.

ALBUMEN PROCESS FOR TRANSPARENCIES.

Iodised Albumen.

Albumen	10 ounces	1000 c.c.
Liquor ammoniæ	½ drachm	6 ,,
Iodide of ammonium	50 grains	11 grammes.
Bromide of ammonium	10 ,,	2 ,,

Silver Bath.

Water	10 ounces	1000 c.c.
Nitrate silver	1 ounce	100 grammes.
Glacial acetic acid	1 ,,	100 ,,

Coat the glass with old iodised collodion and when it has set wash under the tap, drain, and coat with the albumen. When dry, sensitise for 1 minute, wash, and again dry.

Developer.

Pyrogallic acid	30 grains	7 grammes.
Citric acid	20 „	4·5 „
Water	10 ounces	1000 c. c.

Use warm (120° Fahr. or 40° C.) and add 2 or 3 drops of a solution of 20-grain per ounce nitrate of silver (5 per cent.) at the time of using. Fix in a solution of Hyposulphite of soda 4 ounces to the pint (20 per cent.). Tone with gold if the colour is too brown.

LUBRICANT FOR BURNISHING PRINTS.

Castile soap	20 grains	4 grammes.
Alcohol	10 ounces	1000 c. c.

BACKING FOR DRY PLATES TO PREVENT HALATION (TEAPE'S).

Gum solution (ordinary office gum)	1 ounce or part.
Caramel	1 „ „
Burnt sienna, ground in water	2 ounces or parts.
Mix and add alcohol	2 „ „

COLOUR FOR APPLYING TO BRIGHT MACHINERY PRIOR TO PHOTOGRAPHING IT.

Mix white lead with turpentine to the consistence of thin cream, with sufficient lamp-black to form a light slate colour, and then add one-sixth the bulk of japanners' gold size. Paint the machinery over with this. After photograph has been taken, the colour can be quickly removed with a pledget of 'cotton waste' moistened with turpentine or benzoline.

RETOUCHING MEDIUM.

Pale resin	1 ounce or parts.
Oil of turpentine	1 „ „ „
Oil of lavender	2 ounces „ „

TO PREVENT BLISTERS IN ALBUMEN PRINTS.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

STRIPPING THE FILMS FROM GELATINE NEGATIVES.

Soak the negative for ten minutes in a ten per cent. solution of formaline, then rinse and immerse in

Water	1 ounce	500 c. c.
Methylated spirit	1 „	500 „
Glycerine	20 m.	20 „
Hydrofluoric acid	40 „	40 „

till the film lifts at the corners, then strip from the glass and wash. This solution does not cause the film to enlarge.

PRINTING ON PLAIN PAPER.

Prepare the plain paper with

Ammonium chloride	60 to 80 grains	14 to 18 grammes.
Sodium citrate	100 ,,	23 ,,
Sodium chloride	20 to 30 ,,	5 to 7 ,,
Gelatine	10 ,,	2 ,,
Distilled water	10 ounces	1000 c. c.
or, Ammonium chloride	100 grains	23 grammes.
Gelatine	10 ,,	2 ,,
Water	10 ounces	1000 c. c.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes.

The salted paper is sensitised upon a neutral 45-grain silver bath.

PLATINUM TONING BATH FOR PLAIN SILVER PRINTS.

Chloroplatinite of potassium	1 gramme.
Water	1 litre.
Nitric acid	5 to 10 drops.

INVISIBLE INK.

Chloride of cobalt	50 grains	11·4 grammes.
Distilled water	1 fluid ounce	1000 c. c.
Glycerine	10 minims	21 ,,

Dissolve the chloride of cobalt in the distilled water, and add the glycerine.

Writing executed with this ink is invisible on paper, but, on warming, the writing turns blue. On exposure to damp air it becomes invisible again.

SOLUTION FOR MAKING PAPER ADHERE TO METAL.

Tragacanth	30 grammes.
Gum arabic	120 ,,
Water	500 c. c.

REDUCER FOR P.O.P. PRINTS.

Potassium Iodide	5 grains	5 grammes.
Sat. sol. of hypo	1 ounce	500 c. c.
or, Uranium nitrate	5 grains	5 grammes.
Water	2 ounces	1000 c. c.

FILM VARNISH.

Borax	300 grains	30 grammes.
Glycerine	300 m.	30 c. c.
Shellac	600 grains	60 grammes.
Water	20 ounces	1000 c. c.

Boil together for about half an hour, then add —

Methylated spirit	5 ounces	250 c. c.

and filter.

DEXTRINE MOUNTANT.

White dextrine	90 grains	90 grammes.
White sugar	15 ,,	15 ,,
Carbolic acid	2 m.	2 c. c.
Boiling water	¼ ounce	1000 ,,

SEPIA TONES ON PLATINUM PAPER.

Prepare the following solutions:—

1. Potassium oxalate	4 ounces	250 grammes.
Distilled water	16 ,,	1000 c. c.
2. Cupric chloride	124 grains	61 grammes.
Distilled water	8 ounces	1000 c. c.
3. Mercuric chloride	1 ounce	62 grammes.
Distilled water	16 ounces	1000 c. c.
4. Lead acetate	32 grains	16 grammes.
Distilled water	4 ounces	1000 c. c.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 80° C. and the prints developed in it in the usual way and treated to the usual acid clearing baths, and then immersed in strong ammonia 1 part, water 128 parts, for five minutes and then washed and dried.

WATERPROOFING SOLUTION FOR WOOD.

Asphalt	4 ounces	400 grammes.
Pure rubber	30 grains	6 ,,
Mineral naphtha	10 ounces	1000 c. c.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour of this is very inflammable.

TO BLACKEN ALUMINIUM.

Clean the metal thoroughly with fine emery powder, wash well and immerse in

Ferrous sulphate	1 ounce	84 grammes.
White arsenic	1 ,,	84 ,,
Hydrochloric acid	12 ounces	1000 c. c.

Dissolve and add

Water	12 ounces	1000 c. c.

When the colour is deep enough dry off with fine sawdust and lacquer.

DEAD BLACK FOR WOOD.

Borax	30 grains	7·5 grammes.
Glycerine	30 m.	7·5 "
Shellac	60 grains	15 "
Water	8 ounces	1000 c. c.

Boil till dissolved and add

Nigrosine W.S.	60 grains	15 grammes.

or paint the wood first with

Cupric chloride	75 grains	75 grammes.
Potassium bichromate ...	75 "	75 "
Water	2¼ ounces	1000 c. c.

and as soon as the surface dries apply

Aniline hydrochlorate ...	150 grains	150 grammes.
Water	2¼ ounces	1000 c. c.

and wipe off any yellow powder that forms, and repeat the process till black enough, and then rub over with boiled linseed oil.

ACID FIXING BATHS.

(For negatives and bromide paper).

Sodium sulphite solution (1·4)......	2½ ounces	62·5 c. c.
Tartaric acid solution (1·2)......	¾ ounce	18 "

Mix and add to

	Hyposulphite of soda solution (1·5)	40 ounces	1000 c. c.
or,	Hyposulphite of soda	4 "	200 grammes.
	Bisulphite of soda.........................	1 ounce	50 "
	Water	20 ounces	1000 c. c.

SAFE DARK ROOM SCREENS

Vogel's Formula.

1. Aurantia	5 grains	1 gramme.
Water	1 ounce	100 c. c.

if necessary, add a few drops of liq. ammon. fort. to clear solution.

2. Gelatine	96 grains	20 grammes.
Water..........................	1 ounce	100 c. c.

Dissolve by the aid of heat.

3. Rhodamine	40 grains	8 grammes.
Water	2½ ounces	250 c. c.

Mix Nos. 1 and 2 in equal quantities and coat glass with the mixture, allowing 500 minims or 30 c. c. to every 56 sq. inches or 360 sq. cm. Mix 3 parts of No. 3 with 2½ parts of No. 2, and coat another sheet of glass with the mixture, in the same proportion to area. The two when bound together will make a safe light filter.

TONING BROMIDE PRINTS.

Gold Toning.

Ammonium sulphocyanide ...	30 grains	16 grammes.
Chloride of gold	2 ,,	1 gramme.
Boiling water	4 ounces	1,000 c. c.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry. This considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Uranium Toning.

A.	Uranium nitrate...............	48 grains	100 grammes.
	Glacial acetic acid	100 minims	200 c. c.
	Distilled water to	1 ounce	1,000 c. c.
B.	Potassium ferridcyanide ...	48 grains	100 grammes.
	Glacial acetic acid	100 minims	200 c. c.
	Distilled water	1 ounce	1,000 c. c.

For sepia tones use :—

Solution A.	9 parts.
,, B.	5 ,,
Water to	600 ,,

For brown tones use :—

Solution A.	9 parts.
,, B.	5 ,,
Water to	150 ,,

For red tones use :—

Solution A.	7 parts.
,, B.	5 ,,
Water	130 ,,

The prints must be thoroughly freed from hypo and after toning washed in four or five changes of water. Long-continued washing removes the toning. If the whites are stained a very weak bath of carbonate of soda will clear them. According to Loescher the following baths give pure whites :—

A.	Lead nitrate	96 grains	1 gramme.
	Potassium ferriocyanide	288 ,,	3 grammes.
	Distilled water	1 ounce	50 c. c.
B.	Uranium nitrate solution	1 %	
C.	Citric acid solution	5 %	
D.	Ammonium chloride solution	1 %	

For red tones use :—

Solution A.	25 parts.
,, B.	100 ,,
,, C.	100 ,,
,, D.	20 ,,

For sepia tones omit solution.

For green tones treat the uranium-toned print with a 1 % solution of ferrio chloride.

For blue and steel blue tones treat the uranium-toned print with equal parts of a 10 % solution of ferrous sulphate, and a 10 % solution of ferric chloride.

For bright green tones Namias suggests the following bath:—Bleach the prints first in 5 % solution of potassium ferridcyanide, wash well, and immerse in

Ferric chloride	48 grains	5 grammes.
Vanadium chloride	40 "	4 "
Ammonium chloride	96 "	10 "
Hydrochloric acid	96 minims	10 c. c.
Water	20 ounces	1,000 "

Dissolve the vanadium salt in hot water, add the acid, then the other salts, and then the water.

ALUM TONING (for sepia tones).

Hypo	10 ounces	150 grammes.
Alum	1 ounce	15 "
Boiling water	70 ounces	1,000 c. c.

The bath should be kept two or three days before use, and it is preferable to treat the prints to an alum bath first. The bath must be kept at about 120° F., and the prints immersed till the desired colour is reached.

COPPER TONING.

A.	Copper sulphate	30 grains	6 grammes.
	Potassium citrate	150 "	30 "
	Water	10 ounces	1,000 c. c.
B.	Potassium ferridcyanide	25 grains	5 grammes.
	Potassium citrate	150 "	30 "
	Water	10 ounces	1,000 c. c.

Mix in equal parts. This bath gives from warm black to carmine tones according to duration of action.

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPER MAKERS.

AUSTIN EDWARDS'S FORMULÆ.

PYRO.

No. 1.	Pyrogallic acid	1 ounce	or	12·5 grammes.
	Nitric acid	20 drops	,,	0·5 c.c.
	Water	8 ounces	,,	1000 ,,
No. 2.	Sulphite of soda	2½ ounces	or	125 grammes.
	Carbonate of soda (crystals)	2¼ ,,	,,	113 ,,
	Potassium bromide	10 grains	,,	25 ,,
	Water	20 ounces	,,	1000 c.c.

Add the acid to the water before dissolving the pyro.

For correct exposure, use equal parts of Nos. 1 and 2.
For known over-exposure use 2 parts No. 1 and 1 part No. 2.

HYDROQUINONE.

No. 1.	Water	20 ounces	or	1000 c.c.
	Hydroquinone	120 grains	,,	14 grammes.
	Sulphite soda	2 ounces	,,	100 ,,
No. 2.	Water	20 ounces	or	1000 c.c.
	Carbonate of potash	4 ,,	,,	200 grammes.
	Bromide potassium	30 grains	,,	3·5 ,,

Dissolve the hydroquinone in the water before adding the sulphite For use take equal parts of each.

HYDROQUINONE DEVELOPER FOR LANTERN PLATES.

(For Black Tones).

Distilled water	20 ounces	or	1000 c.c.
Hydroquinone	60 grains	,,	7 grammes.
Sulphite soda	2 ounces	,,	100 ,,
Carbonate soda (crystals)	6 ,,	,	300 ,,
Bromide potassium	40 grains	,,	4·6 ,,

Dissolve the hydroquinone in the water and add the other ingredients in the order named.

Time of development, if exposed correctly, about 2 minutes. This developer may be used several times.

PYRO DEVELOPER.

(For Warm Tones).

1.	Water	20 ounces	or	1000 c.c.
	Nitric acid	20 drops	,,	2 ,,
	Sulphite soda	4 ounces	,,	200 grammes.
	Pyrogallic acid	1 ounce	,,	50 ,,

No. 2.	Water	20 ounces or	1000 c. c.
	Bromide ammonium (not potass.)	3 ,, ,,	150 grammes.
	Liq. ammonia ·880	1 ounce ,,	50 ,,

Add the acid to the water, and the other ingredients in the order named.

For use, take 1 part each of Nos. 1 and 2, and dilute with equal quantities of water. For still warmer tones, add 1 part more water, or again double the exposure and add one-fourth more No. 2. This developer may be used several times.

CADETT & NEALL'S FORMULÆ.

PYRO AMMONIA (1).

Stock Solution.

Pyrogallic acid	(avoirdupois) 1 ounce or	136 grammes.
Ammonium bromide	,, ½ ,, ,,	68 ,,
Potass. metabisulphite	,, 1 ,, ,,	136 ,,

Distilled water to make altogether, 7 ounces, 3 drachms fluid, or 1000 c. c.

Dissolve the metabisulphite and bromide in part of the distilled water, before adding the pyrogallic acid.

A.	Stock solution	1 ounce or	50 c. c.
	Distilled water to make altogether	20 ounces=1 pint ,,	1000 ,,
B.	Ammonia (·890)	2½ drachms ,,	16 ,,
	Distilled water to make altogether	20 ounces=1 pint ,,	1000 ,,

Mix equal parts of A and B to make developer.

PYRO AMMONIA (2).

Stock Solution.

Pyrogallic acid	(avoirdupois) 1 ounce or	136 grammes.
Ammonium bromide	,, 1 ,, ,,	136 ,,
Sulphurous or sulphuric or citric acid,	1 drachm ,,	17 c.c. or grammes.

Distilled water to make altogether, 7 ounces, 3 drachms, fluid or 1000 c. c.

Mix the acid with part of the distilled water before adding the bromide and pyrogallic acid.

A.	Stock solution	1 ounce or	50 c. c.
	Distilled water to make altogether	20 ounces=1 pint ,,	1000 ,,
B.	Liq. ammoniæ (·890)	2½ drachms ,,	16 ,,
	Distilled water to make altogether	20 ounces=1 pint ,,	1000 ,,

Mix equal parts of A and B to make developer.

FERROUS OXALATE.

A.	Ferrous sulphate	(avoirdupois) 5 ounces or	250 grammes.
	Sulphuric acid	10 minims ,,	1 c. c.
	Distilled water to make altogether	20 ounces or	1000 ,,
B.	Neutral potass. oxalate	(avoirdupois) 10 ounces or	250 grammes.
	Distilled water to make altogether (fluid)	40 ,, ,,	1000 c. c.

Dissolve the potass. oxalate in about three-quarters of the distilled water, made warm, and make up to bulk after the salt is dissolved.

The ferrous sulphate should be powdered just before solution in about three-quarters of the distilled water to which the sulphuric acid has been previously added. Make up to bulk after solution.

To make developer, add one part of A to four of B. For over-exposure, add a few drops to the mixed developer of a ten per cent solution of potassium bromide.

PYRO SODA.

Stock Solution.

	Pyrogallic acid .... (avoirdupois)	1 ounce	or	100 grammes.
	{ Potassium metabisulphite	40 grains	,,	9
	{ or sulphuric acid................... (fluid)	1 drachm	,,	12 c. c.
	Distilled water to make altogether ,,	10 ounces	,,	1000 ,,
A.	Stock solution .... (fluid)	3 ounces	or	150 c. c.
	Distilled water to make altogether ,,	20 ,,	,,	1000 ,,
B	{ Sodium carbonate (crystals) (avoird.)	11 ounces	or	138 grammes
	{ or ditto ditto (anhydrous) ,,	4 ,,	,,	50 ,,
	Sodium sulphite (recrystd.) ,,	15 ,,	,,	188 ,,
	Distilled water to make altogether ,,	80 ,,	,,	1000 c. c.

Equal parts of each to make developer.

A few drops of a 10 per cent. solution of potassium bromide may be added to the developer when necessary. In very hot weather the hypo bath should not be stronger than 1 lb. of sodium hyposulphite to 2 quarts of water or twenty per cent.

DEVELOPERS FOR THE "CADETT" LANTERN PLATES.

Warm Tones.—Pyro Ammonia.

A.	Pyrogallic acid..................................	40 grains	or	5 grammes.
	Ammonium bromide	40 ,,	,,	5 ,,
	Potass. metabisulphite	120 ,,	,,	14 ,,
	Distilled water to make altogether (fluid)	20 ounces	,,	1000 c. c.
B.	Liq. ammoniæ	150 minims	or	16 c. c.
	Distilled water to make altogether (fluid)	20 ounces	,,	1000 ,,

Equal parts of A and B to make developer.

This formula gives rich warm tones with suitable exposure

For warm black tones, the following may be used:—

A.	Pyrogallic acid	30 grains	or	3.5 grammes
	Sodium sulphite	100 ,,	,,	11 ,,
	Sulphurous acid (or citric acid 5 grains)	5 minims	,,	0·5 c. c.
	Ammonium bromide........................	30 grains	,,	3·5 grammes.
	Distilled water to make altogether......	20 ounces	,,	1000 c. c.
B.	Liq. ammoniæ ·890	40 minims	or	4 c. c.
	Distilled water to make altogether (fluid)	20 ounces	,,	1000 ,,

Equal parts of A and B to make developer.

A rich warm black can be obtained with hydroquinone, and we strongly recommend the following formula:—

A.	Hydroquinone	70 grains	or	8 grammes.
	Potass metabisulphite	10 ,,	,,	1 ,,
	or sulphurous acid	15 minims	,,	1·5 c. c.
	Potassium bromide	35 grains	,,	4 grammes.
	Distilled water to make altogether (fluid)	20 ounces	,,	1000 c. c.
B.	Potassium hydrate (sticks)	140 grains	or	16 grammes.
	Sodium sulphite	700 ,,	,,	80 ,,
	Distilled water to make altogether	20 ounces	,,	1000 c. c.

Equal parts of A and B to make developer.

Black Tones.

Cold, but brilliant black tones are obtained with ferrous oxalate, adding a sufficient quantity of a 10 per cent. solution of potassium bromide to prevent too rapid development.

A.	Ferrous sulphate (avoirdupois)	5 ounces	or	250 grammes.
	Sulphuric acid	10 minims	,,	1 c. c.
	Distil. water to make altogether (avoird.)	20 ounces	,,	1000 ,,
B.	Neutral potass oxalate (avoirdupois)	10 ounces	,,	250 grammes.
	Distilled water to make altogether (fluid)	40 ,,	,,	1000 c. c.

Dissolve the potass oxalate in about ¾ of the distilled water, made warm, and make up to bulk after the salt is dissolved.

The ferrous sulphate should be powdered just before solution in about ¾ of the distilled water to which the sulphuric acid has been previously added. Make up to bulk after solution.

To make developer, add 1 part of A to 4 of B. For over-exposure add a few drops to the mixed developer of a 10 per cent. solution of potassium bromide.

THE KODAK COMPANY'S FORMULÆ.

For Bromide Paper.

No. 1.	Oxalate of Potash	16 ounces	or	333 grammes.
	Hot water	48 ,,	,,	1000 c. c.
No. 2.	Proto-sulphate of iron	16 ounces	or	500 grammes.
	Hot water	32 ,,	,,	1000 c. c.
	Acetic acid	½ drachm	,,	2 ,,
	or,			
	Citric acid	½ ounce	,,	16 grammes.
No. 3.	Bromide of potassium	1 drachm	or	14 grammes.
	Water	10 ounces	,,	1000 c. c.

These solutions must be cooled and kept separately, and should be mixed only for immediate use.

To develop, take in a suitable tray, No. 1, 6 ounces, or 120 c. c.; No. 2, 1 ounce, or 20 c. c.; No. 3, ½ drachm, or 1 c.c. Mix in the order given; use cold. After exposure, soak the paper in water until limp;

then immerse in the developer. The image should appear slowly, and should develop up strong, clear, and brilliant. When the shadows are sufficiently black, pour off the developer and flood the plate with the

Clearing Solution.

Acetic acid	1 drachm	or	4 c.c.
Water	32 ounces	,,	1000 ,,

After fixing, wash thoroughly two hours, and hang up to dry. Use fresh developer for each batch of prints. With a glass-bottomed tray, eight ounces of developer are sufficient for a 25×30 print.

For Kodak Films.

No. 1.	Sulphite of soda	6 ounces	or	188 grammes.
	Hot water	32 ,,	,,	1000 c.c.
	When cold, add—			
	Pyrogallic acid	1 ounce	or	31 grammes.
No. 2.	Carbonate of soda	3 ounces	or	94 grammes.
	Carbonate of potash	1 ounce	,,	31 ,,
	Water	32 ounces	,,	1000 c.c.

To develop, take, for normal exposures, one part each of No. 1 and No. 2, together with two parts of water.

Restrainer.

Bromide of potassium	1 ounce	or	167 grammes.
Water	6 ounces	,,	1000 c.c.

If a number of films are fixed together in one tray, they should be put in *face down*, to avoid abrasion of the sensitive surface. It is well to move them about in the fixing bath, from time to time, in order to remove any air bubbles. After fixing, *wash thoroughly*; then immerse for one minute in the

Soaking Solution.

Water	16 ounces	or	1000 c.c.
Glycerine	½ ounce	,,	31 ,,

Remove from the soaking solution, and pin up each film by *one* of its corners, to dry spontaneously. Any tear drops of the soaking solution should be removed with a bit of blotting-paper or absorbent cotton.

Kodak Self-Toning Solio Paper (Matte and Glossy).

Print slightly deeper than the finished print is required.

Put the prints, without previous washing, into the following bath and keep them moving for three to five minutes:—

Ammonium Sulphocyanide	20 grains.
Water	20 ounces.

Wash for five minutes in running water, or several changes, and fix in

Hypo	3 ounces.
Water	20 ,,

for 10 minutes. Then wash in running water for one hour, or in 15 to 16 changes. The prints may be dried face up on blotting paper; or, if a brilliant surface is required on the glossy paper, squeegee the prints on ferrotype plates or plate glass.

The following alternative bath will give good warm tones on both grades of paper, but is specially recommended for Matte. Put the prints, without previous washing, into the following bath:—

Salt	1 ounce.
Water	20 ounces.

for five minutes, and then place in the following fixing bath:—

Hypo	3 ounces.
Water	20 ,,

for 10 minutes. Wash well and finish as above.

KODAK COLLODIO CHLORIDE PAPER.

Directions.

MATTE.

The printing of Matte Collodio Chloride for platinum tones should be very deep, and, as a general thing, it should be printed without vignetting. Print until the high lights are well tinted. Pay no attention to the shadows, no matter how much they bronze, as that will all tone out. Prints should be washed in six changes of clear water, moving them about in each change; unless the prints are thoroughly washed they will not tone evenly. When the prints are sufficiently washed and ready to tone, they are first placed in a plain gold bath, made alkaline with borax, enough to turn red Litmus paper blue in one minute.

Gold chloride	1 grain.
Water	30 ounces.

add sufficient of a saturated solution of borax to make bath very slightly alkaline (about 25 30 drops).

Tone in this bath to chocolate brown in the deepest shadows by transmitted light. The gold toning bath should be made up from four to five hours before use. Add gold enough to keep the speed of the bath six to eight minutes. If the prints show bleaching in the half-tones before the shadows are toned far enough, add more borax. The alkali acts as a restrainer on the half-tones. The amount to use is the amount necessary to hold the half-tones from bleaching while the shadows tone. When the prints are toned, place in clear water; and when all are toned, wash in three changes of water and tone in the following platinum bath:

Potassium chloroplatinite	4 grains.
Citric acid	100 ,,
Water	30 ounces.

This bath should be made up an hour before use, and, in cold weather, or when the water used is cold, the chill should be taken off the bath with a little warm water. The prints should be toned in this bath until all trace of red or brown is out of the deepest shadows. A mistake often made in toning matte collodio chloride paper with platinum is that it is not toned long enough in the platinum bath. When the prints first go into this bath the whites are muddy, but in a short time they commence to clear, and by keeping the prints in this bath until the whites are thoroughly clear, and every trace of red or brown is out of the deepest shadows, viewed by transmitted light, the most beautiful carbon effects will be produced. Do not be afraid of keeping them in the platinum bath until the desired colour and richness you wish is obtained. When prints are toned in the platinum bath, place in clear water, and when all are toned wash in three changes of water, moving them about by hand in each. After prints are washed, fix in hyposulphite of soda bath, one ounce of crystals to 16 ounces of water, for 15 minutes, moving the prints while fixing. After prints are fixed, wash from an hour to an hour and a half in running water, or ten to twelve changes by hand.

GLOSSY.

Printing.—Print considerably darker than desired when finished. Good bold prints may be made from thin negative by printing under two or three thicknesses of tissue paper.

First Washings.—It is important to wash the free silver and preserving chemicals from paper before toning, but do so by rocking tray through five or six changes of water. Do not handle prints; it is not necessary, and increases the chances of red spots or stains.

Toning.—Tone in the following bath: Water 60 ounces, Kodak Gold Solution 2 drachms (or, if dry chloride of gold is used 2 grains) and ½ drachm of dry acetate of soda. Add a few drops of saturated solution of borax, enough to make the bath slightly alkaline. Allow to stand two or three hours before using. It is a good plan to save this bath from day to day and use part old and part new each time. If the prints fail to clear up, leaving muddy half-tones, too much alkali has been used. If the prints bleach and turn blue in the half-tones, while the shadows remain red, not enough alkali has been used.

For Dark Tones.—We submit the following bath for those desiring deep blue or black tones. This bath can be renewed two or three times by the addition of gold.

Water	32 ounces.
Sulphocyanide of ammonium	½ ounce.
Kodak Gold	2 drachms.

Fixing.—Fix in hypo bath, one ounce hypo to every 16 ounces of water. Have plenty of bath to cover prints nicely, and separate thoroughly. 15 or 20 minutes will be sufficient time.

Final Washing.—Finally, wash thoroughly. It is the frequent and complete change of water that washes the hypo from a print, not continuous soaking. One hour in running water that changes completely every few minutes is sufficient, or seven or eight changes of water if prints are washed by hand.

KODAK PLATINUM PAPER.

Directions.

Printing.—Although not absolutely necessary, it is advisable to use thin rubber pads in the backs of printing frames, especially in damp weather. See that negatives and pads used in printing frames are perfectly dry, or the result will be the same as when paper is exposed to dampness before printing. Print until the image is visible in all parts, although weak and only faintly outlined in the stronger portions of the negative.

Developing.—The developer is simply neutral potassium oxalate and water; 2 ounces of neutral potassium oxalate dissolved in 10 fluid ounces of water. If tones more on the blue black are desired, use the following developer: water, 10 ounces; potassium oxalate, 1 ounce potassium phosphate, half-an-ounce. In preparing developer containing potassium phosphate, always use warm water, as this chemical does not dissolve freely in cold water. Any amount of the developer may be made up and set aside for future use, but should be kept in a well-stoppered bottle. Use sufficient developer to cover the bottom of the tray at least half an inch deep. Develop prints face up. By sliding prints under the developer face up air-bells are avoided and the development may be closely watched from the start. Development, as a rule, only requires from 20 to 30 seconds, but it will do no harm to leave a properly exposed print in the developer a full minute. Prints from strong negatives are very often improved in the half tones by prolonging the development a few seconds. Development should be carried on in a weak light. The temperature of developer should be from 60 to 65° F. Keep up strength of developer by adding fresh stock solution from time to time.

Clearing Bath—As soon as prints are fully developed they are placed faced down directly into a clearing bath of hydrochloric acid and water: one ounce of pure hydrochloric acid to 60 ounces of water. The quality of acid used is of much importance. It should be chemically pure, as ordinary commercial acid will cause yellow prints. Prints should have from three to four changes of acid clearing bath, allowing them to remain in each bath eight to ten minutes and keeping them separated. The last acid bath should be as clear as pure water, showing no yellow tint. This clearing of prints is very important, as permanent results depend on removing all unacted-on chemicals from the paper. A properly treated platinum print consists of nothing but metallic platinum and paper After clearing, the prints are washed about half an hour in running water If not convenient to wash prints in running water give them eight to ten changes in a tray, separating them well in each change.

KODAK SOLIO AND MATTE SOLIO PRINTING OUT PAPERS.

Printing.—Should be done in a strong light if the negatives are hard, only thin and delicate negatives being printed in the shade. The printing should be carried only a little darker than the finished print is required, as the paper loses very little in the subsequent toning and fixing operations.

Toning.—Separate Toning Bath (Sulphocyanide).

By adopting the following method of toning Eastman's Solio P.O.P. any desired tone may be obtained, from a red-brown to a purple-black, and the system ensures both economy in the use of gold, and great uniformity of colour throughout any number of prints. It is based on the principle of allowing a definite amount of gold to a definite number of prints or area of printed paper.

Prepare the following:

Stock Solution.

Chloride of Gold	15 grains (one tube.)
Sulphocyanide Ammonium	150 grains
Water to	30 ozs.

The Sulphocyanide should be dissolved first and the gold added afterwards. Each ounce contains ½ grain of chloride of gold.

To impart to a 1/- packet of paper a cold purple-black tone take six ounces of the stock solution and dilute with water to measure, say, 30 ounces. Treat all the prints at the same time, and allow them to remain in the bath for eight minutes, keeping them in motion as usual in toning.

For a purple-brown colour a packet of paper requires 3 ounces of stock solution, or for a brown colour 1½ ounces of stock solution, whilst one ounce of stock solution will give a red tone.

If it is required to tone less than a packet of paper, a proportionate reduction must be made in the amount of stock solution.

The amount of water to be added to the stock solution is in all cases just as much as is considered necessary for conveniently handling the prints.

Mix the bath to the desired strength and in the desired quantity. Wash the batch of prints well for ten minutes in running water (or in three changes of water). Transfer as rapidly as possible the whole of them, one by one, to the toning bath.

Tone for 8 or 10 minutes, moving the prints all the time.

Rinse well.

Fix for 10 minutes in the following fixing bath:—

Sodium Hyposulphite	3 ounces.
Water up to..	1 pint.

If the weather is warm and the surface of prints becomes soft, immerse for 5 minutes in Alum Bath (Alum 2 ozs., Water 1 pint), having given them 10 minutes to wash after fixing.

Wash for one hour in running water, or in ten changes, keeping the prints moving 2 or 3 minutes in each.

The prints can be dried by laying them upon blotting paper, face upwards, but must not be left between blotting paper, or they may be suspended by one corner and allowed to dry spontaneously.

The foregoing directions apply to an average lot of prints which have been trimmed before toning, Should the prints be from negatives with an excess of heavy shadows or very dark back-grounds, a little more of the stock gold solution should be used, whereas if light half-tones predominate, a little less of the stock will be required.

For those who prefer a Combined Toning and Fixing Bath we give the following formula:—

The tones obtainable are from red to dark brown.

Printing must be carried decidedly darker than the finished pictures should appear.

Stock Solutions.

No. 1	Hypo. 12 ozs. dissolved in water and made up to	2	pints
2	Ammonium Sulphocyanide ½ oz. ,, ,,	5	ounces.
3	Lead Acetate ¼ oz. ,, ,,	5	,,
4	Gold 7 grains ,, ,,	5	,,

Take of No. 1, 7 ozs.; No. 2, 1 oz.; No. 3, 1 oz.; No. 4, 1 oz.

Wash thoroughly, tone and fix in the above bath, and finally wash n running water for about one hour.

NOTE.—The above quantity will tone 1/- packet of paper.

MATTE SOLIO PAPER.

All the foregoing directions apply also to the treatment of Matte Solio, but the Toning Bath which we specially recommend for Matte Solio is the following:—

Sepia Tones.

Stock Solution	Potassium Chloroplatinite ...	5 grains.
	Citric Acid........................	40 ,,
	Sodium Chloride (Salt)	40 ,,
	Water	20 ounces.

This bath keeps well for a month.

Wash the prints from 5 to 10 minutes, and then immerse in the above bath, examining the prints by transmitted light.

Tone to a dark brown or chocolate colour (not black), rinse slightly and immerse the prints in the following bath to stop the toning action

Sodium Carbonate (Washing Soda)	½ ounce.
Water	20 ounces.

Rinse and transfer to the following fixing bath:

Sodium Hyposulphite	3 ounces.
Water	20 ,,

Wash thoroughly in running water or by frequent changes for one hour.

Should it be thought desirable to specially harden the gelatine, use an alum bath as follows:

After fixing the prints, wash them well from 10 to 15 minutes an then immerse for not more than five minutes in

Alum	½ ounce.
Water	20 ounces.

and finally wash thoroughly.

RAPID PRINTING PROCESS BY DEVELOPMENT OF SOLIO.

Print.—Until the image shows distinct detail in all but the high lights.

Developer.—Develop with the following developer until the prints look similar to printed out prints, but rather more brown in colour; this should take five or six minutes.

Hydroquinone	24 grains,
Citric Acid	60 ,,
Acetate Soda	1½ ounces.
Water	30 ounces.

As soon as the prints are dark enough transfer them to a dish containing plenty of clear water (running water if possible), and allow them to wash for about 15 minutes. The prints will continue to develop very slightly when first transferred to the washing water, and for this reason care should be taken not to develop them too dark. Then tone in the sulphocyanide or combined toning and fixing bath in the usual way.

A little extra care should be exercised in putting Solio intended for development into the frames, and taking it therefrom. It should be done in subdued daylight. Development is best done by ordinary lamplight without a yellow shade. Prints made by this process are even more brilliant and show more detail than those fully printed out.

EDWARDS'S FORMULÆ.

PYRO AND AMMONIA DEVELOPER.

No. 1.	Pyrogallic acid	1 ounce or	30 grammes.
	Citric acid	40 grains ,,	3 ,,
	Water	7½ ounces ,,	214 c.c.
No. 2.	Strong ammonia ·880	1 ounce or	28 c.c.
	Bromide of potassium	120 grains ,,	8 grammes.
	Distilled water	7 ounces ,,	200 c.c.

The above will keep good for months, if well corked.

For use, dilute 1 part No. 1 with 19 parts of water, and in another bottle 1 part No. 2 with 19 parts of water. The dilute solutions should be made fresh every day.

To develop a correctly exposed plate or film mix equal parts of these two solutions.

PYRO AND SODA DEVELOPER.

No. 1.	Pyrogallic acid	1 ounce	or	30 grammes.
	Nitric acid	20 drops	,,	1 c. c.
	Water	80 ounces	,,	2 litres 300 c.c.
No. 2.	Sulphite of soda	10 ounces	or	300 grammes.
	Carbonate of soda (washing soda)	8 ,,	,,	226 ,,
	Water	80 ,,	,,	2 litres 300 c.c.
No. 3.	Bromide of potassium	1 ounce	or	30 grammes.
	Water	9 ounces	,,	250 c. c.

To develop, mix equal parts of Nos. 1 and 2, and add 10 minims of No. 3 to each ounce of the mixed developer, or, instead, 3 ounces of No. 3 may be added to the 80 ounces of No. 2. For rapid shutter exposures, omit the bromide.

PYRO AND SODA DEVELOPER WITH METABISULPHITE.

No. 1.	Pyrogallic acid	1 ounce	or	30 grammes.
	Metabisulphite of soda (Boake's)	1 ,,	,,	30 ,,
	Water	80 ounces	,,	2 litres 300c.c.

Dissolve the metabisulphite, and then add the pyro.

No. 2.	Carbonate of soda (washing soda)	12 ounces	or	360 grammes.
	Sulphite of soda	4 ,,	,,	120 ,,
	Water	80 ,,	,,	2 litres 300 c.c.
No. 3.	Bromide of potassium	1 ounce	or	30 grammes.
	Water	9 ounces	,,	250 c.c.

To develop, mix equal parts of Nos. 1 and 2. When working in the summer time in a good light, with full exposure, add 5 minims of No. 3 to each ounce of developer (or to save the trouble of measuring small quantities, 1½ ounces of No. 3 may be added to the 80 ounces of No. 2). In winter the bromide may generally be omitted, and also for rapid shutter exposures, and portrait work in the studio.

HYDROQUINONE DEVELOPER.

No. 1.	Hydroquinone	¼ ounce	or	7 grammes.
	Sulphite of soda	1 ,,	,,	30 ,,
	Bromide of potassium	7 grains	,,	½ gramme.
	Distilled boiling water to make	12 ounces	,,	340 c. c.
No. 2.	Carbonate of potash	½ ounce	or	15 grammes.
	Distilled water to make	12 ounces	,,	340 c. c.

First dissolve the hydroquinone, and then add the sulphite and bromide.

For use mix equal parts of Nos. 1 and 2.

In case of slight over-exposure add a few drops or minims of a 10 per cent. solution of bromide of potassium to each ounce of developer, more or less according to the extent of over-exposure. For considerable over-exposure use the redeveloper.

For under-exposure, pour off the hydroquinone developer and finish development with the eikonogen developer given below.

EIKONOGEN DEVELOPER.

Eikonogen	½ ounce	or	14 grammes.
Carbonate of Potash	1 ,,	,,	30 ,,
Sulphite of soda	2 ounces	,,	60 ,,
Distilled boiling water	20 ,,	,,	600 c. c.

First dissolve the eikonogen, then the sulphite, and lastly the carbonate of potash.

Instead of mixing the developers, the development may be commenced with eikonogen, and when the detail is sufficiently out, hydroquinone substituted for it, without waiting to wash the negative, and the development finished with this, or in case of much over-exposure with the following hydroquinone redeveloper:—

HYDROQUINONE REDEVELOPER.

No. 1.	Hydroquinone	¼ ounce	or	7 grammes,
	Sulphite of soda	2 ounces	,,	60 ,,
	Bromide of potassium	¼ ounce	,,	7 ,,
	Distilled boiling water to make	12 ounces	,,	340 c. c.
No. 2.	Carbonate of soda (washing soda)	2 ounces	or	60 grammes.
	Sulphite of soda	2 ,,	,,	60 ,,
	Distilled water to make	12 ,,	,,	340 c. c.

For use mix equal parts of Nos. 1, and 2.

EDWARDS'S GELATINO-CHLORIDE PLATES.

Development.

Make two stock solutions as follows:—

No. 2.	Neutral oxalate of Potash	2 ounces	or	100 grammes.
	Chloride of ammonium	40 grains	,,	5 ,,
	Distilled water	20 ounces	,,	1000 c. c.
No. 2.	Sulphate of iron	4 drachms	or	25 grammes.
	Citric acid	2 ,,	,,	12·5 ,,
	Alum	2 ,,	,,	12·5 ,,
	Distilled water	20 ounces	,,	1000 c. c.

The above solutions will keep indefinitely.

When required for use, mix equal portions of the above solutions adding No. 2 to No. 1, to form the developer.

EDWARDS'S SPECIAL TRANSPARENCY PLATES.

Pyro and Ammonia Developer.

Warm Tones.

No. 1.	Pyrogallic acid	1 ounce	or	30 grammes.
	Sulphite of soda	4 ounces	,,	120 ,,
	Citric acid	¼ ounce	,,	8 ,,
	Water to make	16 ounces	,,	460 c. c.

First dissolve the sulphite and citric acid, and then add the pyrogallic

No. 2.	Bromide of ammonium	1 ounce	or	30 grammes.
	Liq. ammoniæ ·880	5½ drachms	,,	20 c. c.
	Water to make	16 ounces	,,	460 c. c.

For use, mix 1 part of No. 1 and 3 parts of No. 2, and dilute with water to double the quantity.

Hydroquinone Developer.

Black Tones.

Hydroquinone	60 grains	or	3 grammes.
Sulphite of soda	2 ounces	,,	45 ,,
Carbonate of soda (crystals)	4 ,,	,,	90 ,,
Carbonate of potash	2 ,,	,,	45 ,,
Bromide of potassium	40 grains	,,	2 ,,
Hot distilled water	20 ounces	,,	450 c. c.

For black and white line subjects add 1 drachm of a 60 grain solution of bromide of potassium to each ounce of developer.

Dissolve the hydroquinone in the water, and add the other ingredients in the order named.

Amidol Developer.

Black Tones.

Amidol	80 grains	or	5 grammes.
Soda sulphite	2 ounces	,,	60 ,,
Bromide of potassium	½ ounce	,,	15 ,,
Water	12 ounces	,,	360 c. c.

ELLIOTT & SONS' FORMULÆ.

The "Barnet" Plates, Ordinary.

No. 1.	Ammonia (·880)	1½ ounce	or	75 c. c.
	Water	20 ounces	,,	1000 c. c.
No. 2.	Pyrogallic acid	160 grains	or	18 grammes
	Bromide of ammonium	¾ ounce	,,	38 ,,
	Water	20 ounces	,,	1000 c. c.
	Pure nitric acid	10 drops	,,	1 ,,

For use, mix ½ an ounce of No. 1, ½ an ounce of No. 2 with 3 ounces of water.

Pyro and Ammonia (10 *per cent. Solutions*).

No. 1.	Ammonia (·880)	1 ounce	or	100 c. c.
	Water	9 ounces	,,	900 ,,
No. 2.	Bromide of ammonium	1 ounce	or	100 grammes.
	Water, to make	10 ounces	,,	1000 ,,
No. 3.	Pyro	1 ounce	,,	100 grammes.
	Water, to make	10 ounces	,,	1000 c. c.
	Nitric acid, pure	20 drops	,,	4 ,,

For studio use, take 80 minims (10 c. c.) No. 1, 40 minims (5 c. c.) No. 2, 20 minims (2½ c. c.) No. 3, and make up to 2 ounces (120 c. c.) with water.

The above developer is the same strength as that recommended on the boxes.

For outdoor work, take 80 minims No. 1, 60 minims No. 2, 40 minims No. 3, and make up to 2 ounces with water.

Pyro and Soda Developer.

Solution No. 1.

Pyro	1 ounce	or	12 grammes.
Water	86 ounces	,,	1000 c. c.
Nitric acid, pure	20 drops	,,	0.5 ,,

Solution No. 2.

Pure sulphite soda	10 ounces	or	116 grammes.
Pure carbonate soda (crystals)	9 ,,	,,	105 ,,
Water	86 ,,	,,	1000 c. c.

Use equal parts of Nos. 1 and 2, and dilute with equal bulk of water. To each ounce add 1 or 2 drops of a ten per cent. solution of bromide of potassium.

"BARNET" LANTERN TRANSPARENCY PLATES.

For Cold or Warm Tones (according to exposure and development)

INSTRUCTIONS FOR USE.

Contact Printing.—For black tones the exposure required is about 10 seconds at a distance of 1 foot from an ordinary gas flame; the developer to be used is either No. 1 or 2.

To secure warm tones it is necessary to increase the exposure to 2 or 3 minutes and use formula either No. 3 or 4.

To obtain still warmer (reddish) tones, increase the exposure still further to 5 or 6 minutes and develop with formula No. 5.

Reductions in the Camera.—For black tones with stop *f*-16 in bright diffused light from a half-plate negative an exposure of about 10 seconds is required, using formula No. 1 or 2 for developing.

For warm tones increase the exposure to 2 or 3 minutes and using for developer either formula No. 3 or 4.

For still warmer tones further increase the exposure to 5 or 6 minutes and develop with formula No. 5.

FORMULÆ FOR DEVELOPERS.

Note.—In cold weather all solutions should be raised to a temperature of 60°.

Cold Black Tones.

A

No. 1.	Metol	400 grains	or	11 grammes.
	Soda sulphite	8 ounces	,,	100 ,,
	Water	80 ,,	,,	1000 c. c.

B.

Carbonate of potash	1200 grains or	34 grammes.
Ammonium bromide	240 „ „	7 „
Potassium bromide	480 „ „	14 „
Water	80 ounces „	1000 „

Take equal parts of A and B.

Note.—The ammonium bromide is necessary for the production of absolutely cold black tones ; a larger quantity is not recommended, as it tends to produce a slight veil in the high lights.

Length of time in developing about 2 minutes.

Warm Black Tones.

A.

No. 2.	Hydroquinone	640 grains or	18 grammes.
	Soda sulphite	8 ounces „	100 „
	Potass bromide	120 grains „	3 „
	Water	80 ounces „	1000 c. c.

B.

Sodium hydrate	640 grains or	18 grammes.
Water	80 ounces „	1000 c. c.

Take equal parts of A and B.

This produces a very pleasing warm black. Length of time in developing about 2 minutes.

Warm Brown Tones.

A.

No. 3.	Pyro	1 ounce or	12·5 grammes.
	Soda sulphite	4 ounces „	50 „
	Water	80 „ „	1000 c. c.

B.

Carbonate of ammonia	900 grains or	26 grammes.
Potassium hydrate	750 „ „	21 „
Ammonium bromide	600 „ „	17 „
Water	80 ounces „	1000 c. c.

Take equal parts of A and B.

Length of time in developing about 2 minutes.

Or the following may be used :—

No. 4.—Take equal parts of No. 2 formula and add to each ounce (100 c. c.) 3 grains (·6 gramme) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 3 or 4 minutes.

Very Warm (Reddish) Tones.

No. 5.—Take equal parts of No. 2 formula and add to each ounce (100 c. c.) 6 grains (1·2 gramme) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about minutes.

Fixing Bath.

We recommend the bath not to be made stronger than

Hypo	5 ounces or	250 grammes.
Water	20 ,, ,,	1000 c. c.

Clearing solutions will not be found necessary with these plates.

BARNET BROMIDE PAPER.

(Extra Rapid.)

Platino Matt Surface.—Directions for Working.

Exposure.—For contact work from an average negative about 4 seconds, 18 inches from an ordinary gas burner.

For enlarging it is impossible to give any fixed data, so much depending upon the source of light. It is recommended to make a trial exposure upon a small piece of paper.

After exposure place the print, sensitive side upwards, in a clean developing dish, flood with water for a few seconds, drain off water, and then with one sweep cause the developer to flow evenly and quickly over the whole surface of the print.

Developers.—Ferrous-oxalate.

A.	Oxalate of potash	1 pound or	333 grammes.
	Bromide potass	5 grains ,,	0·2 gramme.
	Hot water	48 ounces ,,	1000 c. c.
B.	Sulphate of iron	1 pound or	500 grammes.
	Citric acid	½ ounce ,,	16 ,,
	Hot water	32 ounces ,,	1000 c. c.

Take 6 ounces of A and 1 ounce of B.

Immediately after developing, the print must be transferred straight into the acid bath.

Acetic acid	1 drachm or	4 c. c.
Water	32 ounces ,,	1000 ,,

We strongly recommend the following

Metol Developer.

A.	Metol	400 grains or	11 grammes.
	Sodium sulphite	8 ounces ,,	100 ,,
	Potass. bromide	50 grains ,,	1·4 ,,
	Water	80 ounces ,,	1000 c. c.
B.	Potass carbonate	8 ounces or	100 grammes.
	Water	80 ,, ,,	1000 c. c.

Take 3 ounces of A and 1 ounce of B.

The image should appear in a few seconds, and development will be complete in about two minutes. Rinse in 3 changes of water and fix in fixing bath as above (no acid bath is necessary with this developer).

To produce softer results, either of the above may be diluted with an equal quantity of water.

After fixing, wash thoroughly in several changes of water for at least 2 hours, squeegee off the superfluous moisture, and hang up to dry.

THE EUROPEAN BLAIR CAMERA COMPANY'S FORMULÆ.

To develop the films soak in water first till limp.

Metol-Hydroquinone Developer.

Metol	75 grains	or 3·75 grammes.
Hydroquinone	100 ,,	,, 5·0 ,,
Sodium sulphite	4 ,,	,, 100 ,,
Sodium carbonate	2 ounces	,, 50 ,,
Water to	40 ,,	,, 1000 c.c.

Ortol Developer.

1. Ortol	130 grains	or 15 grammes.
Potassium metabisulphite	65 ,,	,, 7·5 ,,
Water to	20 ounces	,, 1000 c.c.
2. Sodium carbonate	2 ,,	,, 100 grammes.
Potassium bromide	20 grains	,, 0·25 ,,
Sodium sulphite	2 ounces	,, 100 ,,
Water to	20 ,,	,, 1000 c.c.

For use mix in equal parts.

In all cases of time exposures and for positive work add to the above developers potassium bromide $\frac{1}{4}$ grain per ounce, or 0·5 gramme per 1000 c.c.

As soon as sufficiently developed, rinse the film well in water and place in a fixing bath of

Hypo	4 ounces	or 250 grammes.
Sodium bisulphite	1 ounce	,, 62 ,,
Water to	20 ounces	,, 1000 c.c.

Do not expose to white light till thoroughly fixed.

FOR THE "PREMIER" DRY PLATES.

Pyro-Soda Developer.

1. Pyrogallic acid	120 grains	or 12 grammes.
Sodium sulphite	2 ounces	,, 100 ,,
Potassium bromide	10 grains	,, 1 gramme.
Water	20 ounces	,, 1000 c.c.
2. Sodium carbonate	2½ ,,	,, 125 grammes.
Water	20 ,,	,, 1000 c.c.

For use mix equal parts of 1 and 2. If the plate be under-exposed add more of No. 2; if over-exposed, use less of No. 2 and more of No. 1.

Hydroquinone-Metol Developer.

1. Hydroquinone	50 grains	or 5 grammes.
Metol	50 ,,	,, 5 ,,
Sodium sulphite	1 ounce	,, 50 ,,
Potassium bromide	20 grains	,, 2 ,,
Water	20 ounces	,, 1000 c.c.

2. Sodium carbonate	2 ounces	or	100 grammes.
Water	20 ,,	,,	1000 c.c.

For use take equal parts of each. This developer can be used several times in succession.

Fixing Bath.

Hyposulphitesoda	4 ounces.
Water	20 ,,

Allow the plates to remain in this bath for a minute or two after they seem fixed, and wash well.

GEM DRY PLATE COMPANY'S FORMULÆ.

DEVELOPER FOR PLATES AND FILMS.

No 1. Pyrogallic acid	1 ounce	or	20 grammes.
Potassium bromide	60 grains	,,	3 ,,
Sulphite of soda	6 ounces	,,	120 ,,
Water to	50 ,,	,,	1000 c.c.
No. 2. Washing soda	6 ounces	or	120 grammes.
Water to	50 ,,	,,	1000 c.c.

For use, take equal quantities of No. 1 and No. 2.
For known under-exposure use an increased proportion of No. 2.
For known over-exposure use larger quantity of No. 1.

Alum Bath.

Alum	1 ounce	or	50 grammes.
Water	20 ounces	,,	1000 c.c.

Wash before and after immersing in the alum bath.

Fixing Solution.

Hypo	1 pound	or	250 grammes.
Water	64 ounces	,,	1000 c.c.

LANTERN PLATES.

Developer for Cold or Warm Tones.

(Cold Tones.)

Hydroquinone.

A. Hydroquinone	½ ounce	or	25 grammes.
Citric acid	¼ ,,	,,	12·5 ,,
Potassium bromide	60 grains	,,	7 ,,
Water	20 ounces	,,	1000 c.c.
B. Caustic soda	½ ounce	or	25 grammes.
Sodium sulphite	20 ,,	,,	150 ,,
Water	3 ounces	,,	1000 c.c.

For use, take equal parts of A and B, and dilute with water equal to their combined bulk.

(Warm Tones.)

C. Ammonium carbonate	1 ounce	or 50 grammes.
Ammonium bromide	1 ,,	,, 50 ,,
Water	20 ounces	,, 1000 c. c.

For use, take of the above hydroquinone formula 2 parts, and add 1 part of C.

In obtaining either cold or warm tones, it is well to remember that exposure is the greatest factor. For cold tones, an exposure of 10 to 20 seconds, 1 foot from a No. 5 gas burner, will be ample, and develop as above. For warm and deeply coloured tones, expose from 30 seconds to 3 minutes, and develop with addition of C, always using a slightly increased proportion of C as the exposure is prolonged.

THE ILFORD FORMULÆ.

Stock Solutions.

A. Water	5½ ounces	or 550 c. c.
Nitric acid	20 minims	,, 1 ,,
Pyrogallic acid	1 ounce	,, 100 grammes

This solution will keep good for several weeks.

Or B. Water	5½ ounces	or 550 c. c.
Potassium metabisulphite	70 grains	,, 15 grammes.
Pyrogallic acid	1 ounce	,, 100 ,,

This solution will keep good for several months.

Working Solutions.

No. 1.

Stock solution of pyro, A or B	1 to 2 ounces	or 100–200 c. c.
Water to make up to	20 ,,	,, 1000 ,,

No. 2.

Sodium carbonate, crystals (not bicarbonate) (avoirdupois)	2 ounces	or 100 grammes.
Sodium sulphite ,,	2 ,,	,, 1000 ,,
Potassium bromide	20 grains	,, 2 ,,
Water to make up to	20 ounces	,, 1000 c. c.

For normal exposures take equal quantities of Nos. 1 and 2.

The quantity of stock solution to be used must be regulated by the quality of negative desired. When a full quantity is used, the result is a slowing of the plate, and, at the same time, greater density or contrast of light and shade.

Pour the developer carefully over the plate, avoiding air bubbles, rock the dish, carefully keeping the plate well covered with solution. To obtain proper density, allow the plate to remain after all detail is out. Judge of this by looking through the plate.

To compensate for errors of exposure, the proportions of Nos. 1 and 2 can be varied thus: for under-exposure use more of No. 2 than of No. 1

and for over-exposure more of No. 1 than of No. 2. It is a good plan, when there is a doubt as to the exposure being correct, to commence the development with twice the quantity of No. 1 than of No. 2, and add more of No. 2 if found desirable. To compensate for under-exposure, the mixed developer can also be diluted with water, of course allowing a longer time for its action.

Alum Bath.—After developing, wash the plate well under the tap, and immerse for a few minutes in alum, 1½ ounces; water 20 ounces.

Fixing.—Wash well again, and fix as usual. Hyposulphite of soda, 1 pound; water 40 ounces. Allow to remain in this bath for several minutes after fixation is apparently completed.

Never omit the alum bath in hot weather or under other conditions likely to produce frilling.

ILFORD P.O.P.

Working Instructions.

Printing.—This should be done in shade by preference, unless negatives are specially strong in contrast. The image loses very little depth in toning, &c.

First washing.—For 10 minutes in several changes.

Hardening Bath.—Soak the prints in

Alum	1 ounce.
Common salt	1 ,,
Water	20 ounces.

for 5 to 10 minutes, keeping them moving all the time.

Second washing.—For 10 minutes in several changes.

Toning.—Any of the recognised formulæ for this class of paper may be used, but for simplicity and excellence of results we recommend the following. Make up the following stock solutions :—

No. 1.	Ammonium sulphocyanide	100 grains.
	Water	10 ounces.
No. 2.	Sodium sulphite	10 grains.
	Water	10 ounces.

This solution must be made up only on the day of using; any left over must be thrown away.

No. 3.	Gold chloride	15 grains.
	Water	15 ounces.

When mixing either of the following toning baths, bear in mind that this solution must be added last of all.

For the usual toning bath, take 2 ounces of each of Nos. 1 and 3 and make up to 20 ounces with water.

For the special toning bath, which is strongly recommended, take 2 ounces of each of Nos. 1, 2, and 3, and make up to 20 ounces with water.

Third washing.—For 5 minutes in several changes.

Fixing.—Use new solution for each batch of prints. The following is best strength:—

Hypo	3 ounces.
Water	20 „

Fixation is complete in about 10 minutes.

Final Washing.—For at least 2 hours in running water, or many changes.

Mounting.—Mount with starch paste in the usual way. Prints thus treated and passed through roll give a fine glossy surface, better than albumen. This paper will also give prints of enamelled surface by squeegeeing down on glass in the usual way.

Special notes.—Do not use any excess of sulphocyanide or sulphite over the quantity mentioned.

Use the washing water and all solutions as cold as possible.

Keep the prints moving whilst in the various solutions.

Ilford Bromide Paper and Opals.

Development.—Make the following solutions and use when cold:—

No. 1. Sulphate of iron	2½ ounces	or	250 grammes.
Sulphuric acid	15 drops	„	3 c. c.
Warm water up to	10 ounces	„	1000 „
No. 2. Neutral potassium oxalate	10 ounces	or	250 grammes.
Potassium bromide	20 grains	„	1 gramme.
Warm water up to	40 ounces	„	1000 c. c.

For use, add 1 ounce No. 1 to 4 ounces No. 2, not *vice versa.*

In cases of over-exposure or weak negatives, it is advisable to use half new and half old developer, to give greater brilliancy. Development is complete when image appears fully out. After development and without washing, immerse the prints for about 2 minutes in clearing solution, pour off and repeat.

Clearing Solution.

Water	80 ounces	or	1000 c. c.
Glacial acetic acid	½ ounce	„	6·5 „

Then wash thoroughly for about 10 minutes in several changes of water All the acid must be removed, or fading of prints will result.

Alternative Method of Development.

No. 1. Metol	50 grains	or	5·0 grammes.
Hydroquinone	25 „	„	2·5 „
Sodium sulphite	1 ounce	„	50 „
Water up to	20 ounces	„	1000 c. c.
No. 2. Sodium carbonate (crystals)	½ ounce	or	25 grammes.
Potassium bromide	30 grains	„	3 „
Water up to	20 ounces	„	1000 „

Take equal quantities of No. 1 and No. 2.

It is important to note that no clearing solution is required with this developer.

Fixing.

Water	20 ounces or 1000 c. c.
Hyposulphite of soda.........(avd.)	¼ pound ,, 200 ,,

Allow 15 minutes for thorough fixation. Use fresh solution for each batch of prints.

After fixing, wash for 2 hours in running water or in frequent changes. Allow prints to dry naturally. Work with clean hands and clean dishes.

ILFORD FORMULÆ IN METRIC MEASURES.

ILFORD PLATES.

Stock Solutions.

A.	Pyro	28·4 grammes (1 ounce),
	Nitric acid	20 drops.
	Water	150 c. c.
B.	Pyro	28·4 grammes.
	Potassium metabisulphite	5 ,,
	Water	150 c. c.

Working Solutions.

No. 1.	Stock solution of pyro A or B	25 to 50 c. c.
	Water to make up to	500 ,,
No. 2.	Sodium carbonate	50 grammes.
	Sodium sulphite	50 ,,
	Potassium bromide	1·2 ,,
	Water to make up to	500 c. c.

Alum Bath.

Alum	30 grammes.
Water	400 c. c.

Fixing.

Hypo	400 grammes.
Water	1000 c. c.

ILFORD P.O.P.

Hardening Bath.

Alum	25 grammes.
Common salt	25 ,,
Water	500 c. c.

Toning.

No. 1.	Ammonium sulphocyanide	8 grammes.
	Water	350 c. c.
No. 2.	Sodium sulphite	0·8 gramme.
	Water	350 c. c.
No. 3.	Gold chloride (15 grain tube)	1 gramme.
	Water	425 c. c.

Fixing.

Hypo	75 grammes.
Water	500 c. c.

ILFORD BROMIDE PAPER AND OPALS.

Developer.

No. 1.	Sulphate of iron	50 grammes.
	Sulphuric acid	10 drops.
	Warm water up to	200 c. c.
No. 2	Potassium oxalate	200 grammes.
	Potassium bromide	1 gramme.
	Warm water up to	800 c. c.

Clearing Solution.

Glacial acetic acid	10 c. c.
Water	1600 „

Alternative Developer.

No. 1.	Metol	4 grammes.
	Hydroquinone	2 „
	Sodium sulphite	35 „
	Water up to	700 c. c.
No. 2.	Sodium carbonate	17½ grammes.
	Potassium bromide	2·4 „
	Water up to	700 c. c.

Fixing.

Hypo	100 grammes.
Water	500 c. c.

PLATONA—ILFORD PLATINUM PAPER.

Printing.

Printing frame and pad should be quite dry.

Print until all details are faintly visible. Examine in weak light only.

Developing Formula—Stock Solution.

Potassium oxalate	2 ounces.
Potassium phosphate	½ ounce.
Water	14 ounces.

If unable to obtain potassium phosphate, the sodium phosphate may be substituted, but the former is preferable.

Dissolve the salts in hot water and allow to cool. This solution will keep indefinitely.

For use, take 1 part stock solution and 1 part water.

Develop in weak artificial or diffused light, floating prints face downwards in the solution. The image does not lose in fixing.

Fixing.

Pure hydrochloric acid	1 ounce.
Water	80 ounces.

Immerse prints for about 5 minutes each in three consecutive baths, and then give them a final washing in water for 15 minutes.

The prints are then ready to be dried and mounted.

THE IMPERIAL COMPANY'S FORMULÆ.

"STANDARD" DEVELOPER.

No. 1.

Pyrogallic acid	55 grains	or	6 grammes
Metol	45 ,,	,,	5 ,,
Metabisulphite of potash	120 ,,	,,	14 ,,
Bromide of potassium..................	20 ,,	,,	2 ,,
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

No. 2.

Carbonate of soda (washing soda)	4 ounces	or	200 grammes.
Water (boiled or distilled) to ...	20 ,,	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

"UNIVERSAL" DEVELOPER.

No. 1.

Metol	40 grains	or	5 grammes.
Hydroquinone	50 ,,	,,	6 ,,
Sulphite of soda	120 ,,	,,	14 ,,
Bromide of potassium	15 ,,	,,	2 ,,
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

No. 2.

Caustic potash	180 grains	or	21 grammes
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

"PYRO-SODA" DEVELOPER.

Stock Solution.

Pyrogallic acid	1 ounce	or	111 grammes.
Bromide of potassium	60 grains	,,	13 ,,
Metabisulphite of potash	50 ,,	,,	10 ,,
Water (boiled or distilled) to ...	12 ounces	,,	1000 c. c.

No. 1.

Stock solution	3 ounces	or	150 c. c.
Water (boiled or distilled).........	20 ,,	,,	1000 ,,

No. 2.

Sulphite of soda	2 ounces	or	100 grammes.
Carbonate of soda (washing soda)	2 ,,	,,	100 ,,
Water (boiled or distilled) to ...	20 ,,	,,	1000 c. c.

For use take equal parts of No 1 and No. 2.

“IMPERIAL METOL” DEVELOPER.

No. 1.

Metol	100 grains	or	11·4 grammes.
Metabisulphite of potash	10 ,,	,,	1 ,,
Bromide of potassium	20 ,,	,,	2 ,,
Water (boiled or distilled) to...	20 ounces	,,	1000 c. c.

No. 2.

Sulphite of soda	2 ounces	or	100 grammes.
carbonate of soda	2 ,,	,,	100 ,,
Water (boiled or distilled) to...	20 ,,	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

“HYDROQUINONE” DEVELOPER.

No. 1.

Hydroquinone	150 grains	or	16 grammes.
Metabisulphite of potash	10 ,,	,,	1 ,,
Bromide of potassium	50 ,,	,,	6 ,,
Water (boiled or distilled) to...	20 ,,	,,	1000 c. c.

No. 2.

Sulphite of soda	2 ounces	or	100 grammes.
Caustic soda	100 grains	,,	11 ,,
Water (boiled or distilled) to...	20 ounces	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

After using this developer, always rinse the negative well before transferring to the fixing-bath.

“SINGLE-SOLUTION” DEVELOPER.

Metol	50 grains	or	5·5 grammes.
Hydroquinone	40 ,,	,,	4·5 ,,
Sulphite of soda	500 ,,	,,	57 ,,
Bromide of potassium	25 ,,	,,	3 ,,
Carbonate of soda	500 ,,	,,	57 ,,
Water (boiled or distilled) to...	20 ounces	,,	1000 c. c.

IMPERIAL “SPECIAL” LANTERN PLATES.

For producing Transparencies of a Black Tone.

The exposure required for a negative of ordinary density will be about 5 seconds, at a distance of 24 inches from a medium-size gas-burner.

Developing formula (hydroquinone) is the same as that used with our ordinary plates.

For development, use 1 part of No. 1 to 1 part of No. 2, and 1 part of water.

Metol developer is also excellent.

After development, the manipulations, washing, &c., will be the same as for negatives.

IMPERIAL "SLOW" LANTERN PLATES.

For producing Transparencies of a Warm Tone.

The exposure required for a negative of ordinary density will be about 15 seconds, at a distance of 12 inches from a medium-size gas burner.

Developing formula (hydroquinone) is the same as that used with "special" lantern plates.

IMPERIAL BROMIDE OPALS.

DEVELOPERS.

Metol. A.

No. 1.	Metol	50 grains or	11·4 grammes.
	Dissolve in water	10 ounces ,,	1000 c. c.
	Then add soda sulphite	1 ounce ,,	100 grammes.
No 2.	Soda carbonate (washing soda)	2 ounces or	200 grammes.
	Water to	10 ,, ,,	1000 c. c.
No. 3.	Potassium bromide	½ ounce or	50 grammes.
	Water to	10 ounces ,,	1000 c. c.

The developer for normal exposures to consist of 3 parts of No. 1 to 1 part of No. 2, to each ounce of which may, as a rule, be added 20 minims of No. 3.

Oxalate and Iron. B.

No. 1.	Potash oxalate	4 ounces or	250 grammes.
	Water	16 ,, ,,	1000 c. c.
No. 2.	Iron sulphate	3 ounces or	250 grammes.
	Water	12 ,, ,,	1000 c. c.
	Citric acid	50 grains ,,	9 grammes.

Add 1 ounce of No. 2 to 5 ounces of No. 1; and to every ounce (30 c. c.) of developer add about 10 drops of a ten per cent. solution of potassium bromide.

No. 2 solution must always be added to No. 1, and not *vice versa*.

LUMIÈRE'S FORMULÆ.

PYRO DEVELOPER

No. 1.

Water	300 c.c. or	15 ozs.
Pyro	20 gr. ,,	1 ,,
Soda sulphite	60 ,, ,,	3 ,,
Nitric acid		30 minims.

No. 2.

Water	300 c.c. or	15 ozs.
Soda carbonate	75 gr. ,,	4 ,,
Soda sulphite	60 ,, ,,	3 ,,

Water	60 parts or 1 oz.
No. 1 solution	6 ,, ,, 1 dram.
No. 2 ,,	6 to 10 parts or 1 to 1½ drams.

DIANOL (Diamidophenol).

Water	1000 c.c. or
Anhydrous soda sulph.	30 grammes or
Dianol	5 ,, ,,

This solution should be used quite fresh.

A stock solution of the soda sulphite and water may be made and the dianol added dry in proportionate quantity at time of using.

LUMIÈRE'S CITRATE P.O.P.

GLOSSY AND MATT (Mauve).

Any of the ordinary toning methods may be employed, but the makers specially recommend the use of the following Combined Toning and Fixing Bath, the results obtained with which cannot be beaten for beauty or permanence.

A.

Warm water	1,000 parts.
Hyposulphite of soda	400 ,,
Alum	20 ,,
Lead acetate	2 ,,
Citric acid	2 ,,

Dissolve the hyposulphite, citric acid, and alum, and when cold add the lead acetate. Allow to stand for several hours, and then filter carefully.

B

Water	100 parts.
Gold chloride	1 ,,

To 100 parts of A add from 6 to 8 parts of B, according to tone required.

Printing should be carried on till about one-third darker than ordinary albumen paper.

Before toning wash for ten minutes in frequently changed water.

Afterwards wash for two hours in several changes of water.

For those who prefer the separate baths we give the following formula:

Distilled water	1,000 parts.
Refined chalk	5 ,,
1 per cent. solution of gold chloride	100 ,,

Allow to stand for 24 hours, then filter, and for use add 15 parts of above bath to 100 parts of water.

After toning, rinse prints and transfer to a 1 per cent. solution of alum for a few minutes, wash well, and fix in

Fixing Bath :

Water	1,000	parts.
Hyposulphite of soda	150	,,
Soda bisulphite	6	,,
Alum	4	,,
1 per cent. solution of lead nitrate	15	,,

In this bath the prints will turn to a yellowish red, but will then change rapidly through brown to blue. Take the prints from the bath when the desired tone is obtained, and wash, preferably in running water.

For use with the matt paper, the following platinum bath will be found to produce tones of great beauty :

Water	500	parts.
Salt	2	,,
Pot. chloroplatinite	1	,,
Alum	5	,,

First wash for ten minutes, then tone till the print appears black, wash in several changes of water, add fix in the combined toning and fixing bath before given.

To obtain platinum black tones, add to the platinum bath a few minims of a 1 per cent. solution of gold chloride.

LUMIERE'S PORCELAIN PAPER.

MATT. Mark F.

The Developer recommended is as follows :—

Water	1,000	parts
Anhydrous sulphite of soda	15	,,
Diamidophenol	5	,,
10 % Solution of pot. bromide	2 to 5	,,

This solution is best prepared fresh for each batch of prints, but if desired the soda solution can be made in bulk, and diamidophenol added in proportionate quantities as wanted.

Exposure will vary according to negative density, distance from light, and power of illuminant ; and a trial exposure on a small portion of paper will be the most reliable working guide.

LUMIÈRE'S BROMIDE PAPERS

FOR CONTACT PRINTING.

Mark A. MATT Surface.
Mark C. GLOSSY.

These papers are specially prepared for print-making by contact.

Development and fixing are carried out by the usual methods. The Developer most recommended is as follows :—

Water	1,000	parts
Anhydrous soda sulphite	20	,
Diamidophenol	5	,,
10 % Solution of pot. bromide	2	,,

This developer should be freshly made for each batch of prints, but should it be desired, the soda solution can be made in bulk, and the diamidophenol added at the time of use.

Exposure : 5 to 10 seconds to an ordinary gas burner with a negative of average density, according to distance from flame

Fixing and Washing.—The prints, when removed from the developer, should be well rinsed and then fixed for 5 or 6 minutes in the following

Fixing Bath.

Water	1,000	parts
Hyposulphite of soda	200	,,
Soda bisulphite	100	,,
Alum	2	,,

After fixing wash prints thoroughly and hang up to dry.

LUMIÈRE'S DEVELOPERS.

DIANOL (Diamidophenol).

Plates.

For normal exposures the following formula will be found to produce fine results:—

Water	1,000	parts.
Anhydrous sulphite of soda	30	,,
Dianol	5	,,

Papers.

The following formula will be found to give the best results:—

Water	1,000	parts.
Anhydrous sulphite of soda	20	,,
Dianol	5	,,
10 per cent. Solution of bromide of potassium	2	,,

It is advisable that solutions of dianol be made up at the time of working as the developer gradually loses power on keeping. The Sulphite solution can be made up in quantities and dianol added as used.

DIANINE (Diamidoresorcine).

Formula.

Water	100	parts.
Anhydrous sulphite of soda	3	,,
Dianine	1	,,

The correction of over-exposure is best attained by the addition of a 10 per cent. solution of potassium bromide to the developer, while the increase in the proportion of soda sulphite will be found to produce a marked effect in the development of under-exposures and instantaneous subjects.

HYDRAMINE.

Proportions for development of normal exposures. Dissolve in order given :—

Water	1,000	parts.
Anhydrous sulphite of soda	15	,,
Caustic lithia	3	,,
Hydramine	5	,,

For over-exposed plates the addition of a few drops of a 10 per cent. solution of potassium bromide is recommended, while for under-exposures development may be greatly simplified by the addition of small quantities of a 1 per cent. solution of caustic lithia.

PARANOL (Paramidophenol).

For normal exposures dissolve in order given :—

Water	850	parts.
Anhydrous sulphite of soda	150	,,
Caustic lithia	8	,,
Paranol	40	,,

Should ordinary water be used light flakes are liable to form but these may be disregarded.

QUINOMET.

(Formerly known as Metoquinone).

Normal Developer (Quinomet).

Hot water	1,000	parts
Quinomet	9	,,
Anhydrous soda sulphite	60	,,

Dissolve the quinomet thoroughly in hot water and then add the soda sulphite.

If a more vigorous developer is required, add to the above formula either 10 parts of soda carbonate or 30 parts of acetone.

Lumière's Formosulphite may be most advantageously employed in conjunction with quinomet, and the following formula gives excellent results either with plates, films or papers and is strongly recommended.

Hot water	1,000	parts
Quinomet	9	,,
Lumière's Formosulphite	60	,,

Plates, much under-exposed, will often produce good results if instead of carbonate of soda or acetone, an addition of five parts of caustic lithia be made to the normal developer.

Over exposure is best dealt with by the use of potassium bromide, a 10 per cent. solution of which may be added to the normal developer as required.

Quinomet is also very suitable for stand development, and we give below a formula which gives very fine results when used in an upright bath. Time of development with this formula is about one hour.

Water	4,000 parts
Quinomet	5 „
Anhydrous soda sulphite	50 „
10 per cent. solution of pot. bromide	5 „

For the development of papers, we recommend the following formula:

Water	1,000 parts
Quinomet	9 „
Anhydrous soda sulphite	60 „
„ soda carbonate........................	10 „
10 per cent. solution of pot. bromide	10

IMPERIAL P.O.P.

Directions for Use.

Hard negatives should be printed in strong light, delicate negatives only in the shade.

Prints should be rather darker than the finished picture is desired.

We specially recommend the following bath and mode of procedure for excellence and uniformity of result.

After printing, wash thoroughly for ten to fifteen minutes in running water before immersion in the Toning Solution.

In hot weather, if the surface of the prints become soft, immerse after washing, in an alum bath (alum 1 ounce, water 10 ounces), leave for ten minutes, wash again in running water for five to ten minutes and place in the following toning bath.

SULPHOCYANIDE TONING BATH.

Stock Gold Solution.

	Chloride of gold	15 grains	18 grammes.
	Water (distilled or boiled) to...	15 drachms	1000 c. c.
No. 1.	Sulphocyanide of ammonium	75 grains	8.5 grammes.
	Water (boiled or distilled) to	20 ounces	1000 c. c.
No. 2.	Stock gold solution..................	5 drachms	31 c. c.
	Water to..................................	20 ounces	1000 „

For use, take equal quantities of No. 1 and No. 2.

Add solution No. 2 slowly to solution No. 1, stirring all the time. Make up the solutions exactly as above, and follow out the instructions carefully.

The prints should tone in five to ten minutes.

When toning has been judged sufficient, wash for about five minutes and transfer to the following fixing bath :—

Hyposulphite of soda	3 ounces	150 grammes.
Water to..................................	20 „	1000 c. c.

After fixation is complete (about ten minutes), wash thoroughly for one hour.

MARION'S FORMULÆ.

For portraiture the following is recommended:—

PYRO STOCK SOLUTION.

Pyrogallic acid	1 ounce	or	50 grammes.
Sodium sulphite	4 ounces	,,	200 ,,
Sulphuric acid	1 drachm	,,	6 c. c.
Water to make up	20 ounces	,,	1000 ,,

SODA STOCK SOLUTION.

Sodium carbonate cryst.	8 ounces	or	400 grammes.
Sodium sulphite	4 ,,	,,	200 ,,
Potassium bromide	1 drachm	,,	7 ,,
Water to make up	20 ounces	,,	1000 c. c.

For Development.

Five ounces of each stock solution made up separately to 20 ounce (1000 c. c.) with water and mixed in equal parts at the time of using. When very soft negatives are required—or only a minimum of exposure can be given—the bromide of potassium may be omitted.

PYRO-AMMONIA.

Pyrogallic acid	1 ounce	or	100 grammes.
Ammonium bromide	1 ,,	,,	100 ,,
Citric acid	1 drachm	,,	14 ,,
Water to make up	10 ounces	,,	1000 c. c.

AMMONIA.

Strongest liquid ammonia ·880	2 ounces	or	200 grammes.
Water to make up	10 ,,	,,	1000 c. c.

Two ounces of each of above separately made with water to 20 ounces (1000 c. c.) form the solutions for use, equal parts being mixed together at the time of development.

HYDROQUINONE DEVELOPER.

Hydroquinone Solution.

Hydroquinone	40 grains	or	grammes.
Sodium sulphite, pure	120 ,,	,,	27 ,,
Potassium brom.	5 ,,	,,	1 ,,
Citric acid	5 ,,	,,	1 ,,
Water to make up to	10 ounces	,,	1000 c. c.

Alkali Solution.

Potass. hydrate, pure	120 grains	or	27 grammes.
Water to make up to	10 ounces	,,	1000 c. c.

This developer, mixed in equal proportions, will contain per ounce Hydroquinone, 2 grains; sulphite, 6 grains; brom., ¼ grain; citric ¼ grain; hydrate, 4 grains.

FOR GELATINO-CHLORIDE PLATES.

IRON.

For Cold Tones.

No. 1.	Potass. citrate	100 grains	or	230 grammes.
	Potass. oxalate	30 „	„	69 „
	Hot distilled water to make up to	1 ounce	„	1000 c. c.

For Warm Tones.

No. 2.	Citric acid	90 grains	or	206 grammes.
	Ammonium carbonate	60 „	„	137 „
	Cold distilled water to make up to	1 ounce	„	1000 c. c.

For Extra Warm Tones.

No. 3.	Citric acid	130 grains	or	297 grammes.
	Ammonium carbonate	40 „	„	92 „
	Cold distilled water to make up to	1 ounce	„	1000 c. c.

In mixing the solutions Nos. 2 and 3, it is better to place the crystals of the salts into a deep vessel, and, after adding the water, leave alone till all effervescence ceases. It is advisable to make it over night.

To three parts of either of the above add one part of the following at the time of using:—

Sulphate of iron	120 grains	or	275 grammes.
Sulphuric acid	1 drop	„	2 c. c.

Make up with distilled water to 1 ounce 1000 c. c.

Either of these developers should give clear glass in the unexposed parts of the picture; but, if at any time the slightest fog is found, it should at once be cured by the addition of a trace of either potassium bromide or sodium chloride. Bromide is better with No. 1, and chloride with either No. 2 or No. 3. A convenient form of using these will be to keep a ten per cent. solution of each of these salts, and one or two minims to each ounce of developer will be found a powerful restrainer.

HYDROQUINONE.

No. 1.	Hydroquinone	48 grains	or	11 grammes.
	Sodium sulphite	320 „	„	73 „
	Ammonium bromide	2 „	„	0·5 „
	Water to make up to	10 ounces	„	1000 c. c.
No. 2.	Ammonium carbonate	100 grains	or	23 grammes.
	Sodium carbonate	100 „	„	23 „
	Water to make up to	10 ounces	„	1000 c. c.

Equal proportions of each are mixed together, according to size of plate to be developed at the time of using.

Different alkalies may be substituted for those mentioned, such as potassium carbonate, sodium silicate, potassium hydrate, sodium hydrate, &c.; but, in all cases, a small proportion of bromide should be used.

A number of plates may be developed one after the other in the same solution.

EIKONOGEN.

This developing agent, first introduced by us, will be found to give admirable results of a pleasing colour.

Formula.

Sulphite soda, pure	200 grains or	46 grammes.
Eikonogen	50 „ „	11 „
Potassium bromide	5 „ „	1 „
Water to make up to	10 ounces „	1000 c. c.

Sodium carbonate	160 grains or	37 grammes.
Water to make up to	10 ounces „	1000 c. c.

Equal parts to be mixed together at time of using.

FOR CHLORO-BROMIDE PLATES.

Pyrogallic Development.

A.	Pyrogallic acid	40 grains or	9 grammes.
	Pure sodium sulphite	16 „ „	4 „
	Citric acid	5 „ „	1 „
	Water	10 ounces „	1000 c. c.

B.	Liq. am. fort	40 minims or	8·3 c. c.
	Potassium bromide	40 grains „	9 grammes.
	Water to make up to	10 ounces „	1000 c. c.

Equal parts of the solutions to be mixed at the time of using.

A very pleasing warm colour will be obtained by adding to the B solution 200 grains (46 grammes) of ammonium carbonate, but the time of development will be increased.

Ferrous-oxalate Development.

The saturated solutions of potassic oxalate and iron sulphate may be used in the proportion of three or four parts of the former to one of the latter, with the addition of one grain of potassium bromide to each ounce of developer, adding more bromide and increasing the amount of exposure when warmer tones are required.

To keep the iron solution from oxidising, one drop of sulphuric acid should be added to each ounce of water before dissolving the salt.

The ferrous oxalate gives a blacker-coloured image than pyrogallic developer.

The time of development will vary from two to four minutes, according to temperature and density of image required.

Hydroquinone Developer.

Hydroquinone Solution.

Hydroquinone	40 grains or	9 grammes.
Sodium sulphite, pure	120 „ „	27 „
Potassium bromide	5 „ „	1 gramme.
Citric acid	5 „ „	1 „
Water to make up to	10 ounces „	1000 c. c.

Alkali Solution.

Potassium hydrate, pure	80 grains	or	18 grammes.
Water to make up to	10 ounces	,,	1000 c. c.

Equal parts to be mixed together at time of using.

It is advisable that all solutions should be made with distilled water, though not absolutely essential.

Several plates may be developed in the same solution.

EIKONOGEN DEVELOPER.

This developer will be found to suit these equally well with slight modification.

A small proportion of bromide must be used to ensure absolute clearness in the unexposed parts.

Formula.

Sodium sulphite	400 grains	or	91 grammes.
Potassium bromide	5 ,,	,,	1 ,,
Eikonogen	100 ,,	,,	23 ,,
Water	10 ounces	,,	1000 c. c.

Sodium carbonate	320 grains	or	73 grammes.
Water to make up to	10 ounces	,,	1000 c. c.

Equal parts of each to be mixed together at time of using.

FOR ARGENTIC BROMIDE OPALS.

Formula for Amidol Developers.

Amidol	20 grains	or	5 grammes.
Sodium sulphite	200 ,,	,,	46 ,,
Potassium bromide	20 ,,	,,	5 ,,

Made up to 10 ounces (1000 c. c.) with water.

Form the developer in one solution ready for use. Plates developed with this formula will not require the acid bath previous to fixing.

Formula for Eikonegen Developer.

Eikonogen	40 grains	or	9 grammes.
Sodium sulphite	160 ,,	,,	37 ,,
Lithium carbonate	2 ,,	,,	0·5 ,,
Water to make up to	10 ounces	,,	1000 c. c.

This will keep for a considerable time if well corked.

One drop of a ten per cent. solution of potassium bromide may be added to each ounce of developer.

Plates developed with eikonogen will not require the acid bath previous to fixing.

MARIONA PAPER (P.O.P.).

Directions.—Print as with albumenised papers, slightly darker than required for the finished picture, or for partial development, as instructions below.

Washing.—After printing, wash thoroughly in several changes of water from ten to fifteen minutes.

Toning.—This paper may be toned with any of the usual baths, but the following are recommended:—

PLATINUM TONING.—FOR SEPIA TONES.

Stock Solution.

A. Potassium chloro-platinite, 15 grains (2.3 grammes) in 15 ounces (1000 c.c.) of water, to which have been previously added 5 minims (½ c.c.) of hydrochloric acid.

B. Citric acid	160 grains	46 grammes.
Chloride sodium	160 „	46 „
Water	8 ounces	1000 c.c.

Take 2 ounces (60 c.c.) from A and 1 ounce (30 c.c.) from B, and make up to 1½ pints (900 c.c.) with water. This is sufficient for toning two sheets.

GOLD TONING.—CARBONATE BATH.

A. Stock solution of gold chloride, 15 grains tube in 15 ounces of water (2 3 grammes per litre).

B. Sodium carbonate (common washing soda), 30 grains in 15 ounces of water. (4½ grammes per litre).

Take 2½ ounces (75 c.c.) each of A and B, and make up to 1 pint (600 c.c.). This should tone about 2½ sheets of paper.

GOLD TONING.—SULPHOCYANIDE BATH.

A. Stock solution of gold chloride, 15 grains in 15 ounces of water (2·3 grammes per litre).

B. Stock solution of ammonium sulphocyanide containing 15 grains to every ounce of water (35 grammes per litre).

For use, take one ounce (28 c. c.) each of A and B, and make up to 8 or 10 ounces (about 250 c. c.) with water, for each sheet of paper to be toned. The bath should be fresh every time.

Washing after Toning.—To be thoroughly washed in several changes of water, then placed in the fixing bath.

Fixing Bath.—Dissolve 3 ounces (150 grammes) of hypo in 1 pint of water (1000 c. c.). Keep the prints moving for at least 10 minutes.

Final Washing.—In running water, or several changes of water, for at least two hours.

Alum Bath.—In warm weather or hot climates it is advisable to use this bath before toning; strength about ten per cent., or chrome alum one per cent. for ten minutes, prints being again thoroughly washed before toning.

Partial Development.—This method will be found very convenient in dull weather, or even at night by magnesium or electric light. Print till the image is fairly visible, then immerse without washing in a ten per cent. solution of potassium bromide for four or five minutes. Then, after washing for a few minutes, place the print in the following developer mixed in equal proportions:—

A.	Hydroquinone	80 grains	9 grammes.
	Sodium sulphite	320 ,,	37 ,,
	Make up with distilled water to	20 ounces	1000 c. c.
B.	Sodium carbonate	400 grains	460 grammes.
	Ammonium carbonate	400 ,,	460 ,,
	Ammonium bromide	40 ,,	46 ,,
	Make up with distilled water to	2 ounces	1000 c. c.

Continue the development until all but the faintest details are visible, then immediately wash the print thoroughly in running water to remove entirely the developer before placing it in the toning bath. All after-treatment will be the same as given above for printed-out prints.

MAWSON & SWAN'S FORMULÆ.

The "Mawson," "Electric," or "Castle" Plate.

Developers.

Pyro-ammonia Developer.

Stock Solution (ten per cent.).

Pyrogallic acid	480 grains	or	110 grammes.
Bromide of ammonium	240 ,,	,,	55 ,,
*Metabisulphite of potassium	480 ,,	,,	110 ,,
Distilled water to make up (fluid)	10 ounces	,,	1000 c. c.

Dissolve the metabisulphite in part of the water, then add the other ingredients, and make up to bulk with water.

A.	Stock solution	300 minims	or	62 c. c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,
B.	Liq. ammonia ·880	70 minims	or	14·5 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Pyro-soda Developer.

A.	Pyrogallic acid	60 grains	or	14 grammes.
	*Metabisulphite of potassium ...	15 ,,	,,	3·5 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Washing soda	600 grains	or	137 grammes.
	Sulphite soda	800 ,,	,,	183 ,,
	Distil. w to make up to (fluid)	10 ounces	,,	1000 c. c.

Use equal parts of A and B mixed at time of developing.

To correct errors in exposure:—If under-exposed, use a larger proportion of B; if over-exposed, decrease the proportion of B, and add a few drops of a ten per cent. solution of bromide of potassium.

* Metabisulphite of potassium is unequalled as a preservative of pyrogallic acid in solution. If not at hand, substitute, for each grain of metabisulphite, sulphuric acid ½ minim *plus* sulphite of soda, 2½ grains.

Eikonogen Developer.

A.	Eikonogen	100 grains or	23 grammes.
	Sulphite of soda (recrystd.)	100 ,, ,,	23 ,,
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.
B.	Carbonate of potassium (com.)	1200 grains or	274 grammes.
	Sulphite of soda (recrystd.)	500 ,, ,,	114 ,,
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.

Use 3 parts of A to 1 part of B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grains or	9 grammes.
	Metabisulphite of potassium	40 ,, ,,	9 ,,
	Bromide of potassium	5 ,, ,,	1 gramme.
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.
B.	Caustic potass (sticks)	80 grains or	18 grammes.
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.

Use equal parts of A and B mixed at time of developing.

THE MAWSON PHOTO-MECHANICAL PLATE.

DEVELOPERS.

Pyro-ammonia Developer.

A.	Pyrogallic acid	30 grains or	7 grammes.
	Bromide of ammonium	30 ,, ,,	7 ,,
	Metabisulphite of potassium	30 ,, ,,	7 ,,
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.
B.	Liq. ammoniæ ·880	70 minims or	14·6 c. c.
	Distil. water to make up to (fluid)	10 ounces ,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grains or	9 grammes.
	Bromide of potassium	10 ,, ,,	2 ,,
	Metabisulphite of potassium	40 ,, ,,	9 ,,
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.
B.	Caustic potass (sticks)	80 grains or	18 grammes.
	Distil. water to make up to (fluid)	10 ounces ,,	1000 c. c.

Use equal parts of A and B mixed at time of developing.

The Mawson Lantern Plate.

Developers.

Exposure.—A negative of average density requires about 15 seconds at 1 foot from a No. 6 bat's-wing burner. Short exposure tends to produce black tones; long exposure, brown tones.

Either of the following developers may be used, though we give the preference to the pyro-ammonia, greater variety of tone being available by it.

Development begins rather slowly, especially with the hydroquinone formula, afterwards proceeding more rapidly.

Pyro-ammonia Developer.

A.	Pyrogallic acid	20 grains	or	5 grammes.
	Bromide of ammonia	20 ,,	,,	5 ,,
	Metabisulphite of potassium	50 ,,	,,	11 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.
B.	Liq. ammoniæ ·880	70 minims	or	15 c.c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grains	or	9 grammes.
	Bromide of potassium	40 ,,	,,	9 ,,
	Metabisulphite of potassium	40 ,,	,,	9 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.
B.	Caustic potass (sticks)	80 grains	,,	18 grammes.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.

Use equal parts of A and B mixed at time of developing.

Eikonogen Developer.

A.	Eikonogen	100 grains	or	23 grammes.
	Bromide of potassium	20 ,,	,,	4·6 ,,
	Sulphite of sodium (recrystd.)	100 ,,	,,	23 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.
B.	Washing soda	600 grains	or	137 grammes.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.

Use equal parts of A and B mixed at time of developing.

Ferrous-oxalate Developer.

A.	Neutral oxalate of potassium	1200 grains	or	274 grammes.
	Bromide of potassium	5 ,,	,,	1 ,,
	Citric acid	15 ,,	,,	3 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.
*B.	Ferrous sulphate	1600 grains	or	365 grammes.
	Citric acid	120 ,,	,,	27 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c.c.

Use 7 parts of A and 1 part of B, mixed at time of developing.

* Should this solution after keeping change to a brown colour, discard and mix afresh.

The Mawson Opal Plate.

Developer.

A.	Neutral oxalate of potassium	1200	grains	or	274	grammes.
	Bromide of potassium	5	,,	,,	1	,,
	Citric acid	15	,,	,,	3	,,
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.
B.	Ferrous sulphate	1600	grains	or	365	grammes.
	Citric acid	120	,,	,,	27	,,
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use 7 parts of A and 1 part of B, mixed at the time of developing.

Should B, after keeping, change to a brown colour, discard and mix afresh.

The Mawson Bromide Paper.

Developer.

A.	Neutral oxalate of potassium	1200	grains	or	274	grammes.
	Bromide of potassium	5	,,	,,	1	gramme.
	Citric acid	15	,,	,,	3	grammes.
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.
B.	Ferrous sulphate	1600	grains	or	365	grammes.
	Citric acid	120	,,	,,	27	,,
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use 7 parts of A and 1 part of B, mixed at the time of developing.

Should B, after keeping, change to a brown colour, discard, and mix afresh.

THE PAGET PRIZE PLATE COMPANY'S FORMULÆ.

Pyro-Ammonia.

No. 1.	Pyrogallic acid	1	ounce	or	50	grammes.
	Citric acid	60	grains	,,	7	,,
	Sodium sulphite (pure)	2½	ounces	,,	125	,,
	Distilled water to make	20	,,	,,	1000	c. c.
No. 2.	Liq. Ammoniæ ·880	1	ounce	or	50	c. c.
	Ammonium bromide	80	grains	,,	9	grammes.
	(For Phœnix plates, 120 grains or 14 grammes.)					
	Distilled water to make	20	ounces	or	1000	c. c.

One part of each to 10 parts of water.

Pyro Soda.

No. 1.	Pyrogallic acid	¼	ounce	or	12·5	grammes.
	Sulphuric acid	5	drops	,,	0·5	c. c.
	Distilled water to make	20	ounces	,,	1000	,,
No. 2.	Carbonate of soda (cryst. pure)	2	ounces	or	100	grammes
	Sulphite of soda (pure)	2	,,	,,	100	,,
	Distilled water to make	20	,,	,,	1000	c. c.

Equal parts of each.

HYDROQUINONE.

No. 1.	Hydroquinone	1 ounce	or	50 grammes.
	Methylated spirit	10 ounces	,,	500 c. c.
	Sulphurous acid	½ ounce	,,	25 ,,
	Potassium bromide	¼ ,,	,,	12 grammes.

Dissolve the hydroquinone in the spirit, and add the acid. In another vessel dissolve the potassium bromide in 3 ounces (150 c. c.) of distilled water. Mix the two solutions, and make up to 20 ounces (1000 c. c.) with distilled water.

No. 2.	Caustic soda (in sticks)	1 ounce	or	50 grammes.
	Sodium sulphite	5 ounces	,,	250 ,,
	Distilled water to make	20 ,,	,,	1000 c. c.

One part of each to 4 parts of water.

If this be found to give too hard a negative, use more water

EIKONOGEN.

No. 1.	Eikonogen	½ ounce	or	17 grammes.
	Sodium sulphite	1½ ,,	,,	50 ,,
	Potassium bromide	8 grains	,,	0·6 gramme.
	Distilled water to make	30 ounces	,,	1000 c. c.

Sixty grains (5 grammes) hydroquinone added to above is a decided improvement, increasing brilliancy and density.

No. 2.	Potassium carbonate	1 ounce	or	100 grammes.
	Distilled water to make	10 ounces	,,	1000 ,,

Three parts of No. 1 to one part of No. 2.

DEVELOPMENT.

For BLACK TONES any of the following formulæ are suitable.

Pyro Ammonia.

Solution No. 1.

Pyrogallic acid	1 ounce	or	100 grammes.
Sodium sulphite	1½ ,,	,,	150 ,,
Citric acid	¼ ,,	,,	25 ,,
Distilled water to	10 ounces	,,	1000 c. c.

Solution No. 2.

Liquor ammoniæ, ·880	1 ounce	or	100 grammes,
Ammonium bromide	1 ,,	,,	100 ,,
Distilled water to	10 ounces	,,	1000 ,,

For use, take 45 minims (4·7 c. c.) of each solution and make up with water to 2 ounces (100 c. c.).

Ferrous-oxalate Developer.

Solution No. 1.

Neutral oxalate of potash	16 ounces	or	320 grammes.
Citric acid	60 grains	,,	3 ,,
Hot water	50 ounces	,,	1000 c. c.

Solution No. 2.

Protosulphate of iron	4 ounces or	500 grammes
Citric acid	15 grains ,,	4 ,,
Hot water	8 ounces ,,	1000 c. c.

Solution No. 3.

Bromide of potassium	¼ ounce or	25 grammes.
Water	10 ounces ,,	1000 c. c.

For development, take 6 ounces (60 c. c.) of No. 1 and add 1 ounce (10 c. c.) of No. 2 and 24 drops (½ c. c.) of No. 3. Gives cold black tones.

Eikonogen Developer.

Solution No. 1.

Eikonogen	½ ounce or	17 grammes.
Sodium sulphite	1½ ,, ,,	50 ,,
Potassium bromide	8 grains ,,	0·4 ,,
Distilled water to	30 ounces ,,	1000 c. c.

Solution No. 2.

Potassium carbonate	1 ounce or	100 grammes.
Distilled water to	10 ounces ,,	1000 c. c.

Take three parts of No. 1 to one part of No. 2 solution.

Rodinal Developer.

Rodinal concentrated solution	1 part or	33 c. c.
Water	30 parts ,,	1000 ,,

This is a very clean developer, and gives a rich black colour.

Hydroquinone.

Solution No. 1.

Hydroquinone	½ ounce or	25 grammes.
Sulphurous acid	¼ ,, ,,	12·5 c. c.
Potassium bromide	60 grains ,,	7 grammes.
Water to	20 ounces ,,	1000 c. c.

Solution No. 2.

Caustic soda	½ ounce or	25 grammes.
Sodium sulphite	2½ ounces ,,	125 ,,
Water to	20 ,, ,,	1000 c. c.

For use, take ½ ounce (50 c. c.) of each to 1 ounce (100 c. c.) of water

WARM TONES.—DEVELOPER.

Solution No. 1.

Hydroquinone	½ ounce or	25 grammes.
Sulphurous acid	¼ ,, ,,	12·5
Potassium bromide	60 grains ,,	7
Water to	20 ounces ,,	1000 c. c.

Solution No.

Caustic soda...........................	½ ounce	or	25 grammes.
Sodium sulphite	2½ ounces	,,	125 ,,
Water to	20 ,,	,,	1000 c. c.

Solution No. 3.

Bromide of ammonium	1 ounce	or	50 grammes.
Carbonate of ammonium	1 ,,	,,	50 ,,
Water to	20 ounces	,,	1000 c. c.

Brown.

Exposure: 60 seconds 1 foot from gas-flame, or 2 inches of magnesium wire burnt at a distance of 3 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 100 minims (20 c. c.); water to 2 ounces (200 c. c.). Time required in development, about 5 minutes.

Purple brown.

Exposure: 90 seconds 1 foot from gas-flame, or 3 inches of magnesium wire burnt at a distance of 3 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 200 minims (40 c. c.); water to 2 ounces (200 c. c.). Time required in development, about 10 minutes.

Purple.

Exposure: 3 minutes 1 foot from gas-flame, or 3 inches of magnesium wire burnt at a distance of 2 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 250 minims (50 c. c.); water to 2 ounces (200 c. c.). Time required in development, about 12 minutes.

Red.

Exposure: 5 minutes 1 foot from gas-flame, or 5 inches of magnesium wire burnt at a distance of 2 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 300 minims (60 c. c.); water to 2 ounces. Time required in development, about 15 minutes.

PRINTING-OUT OPALS AND LANTERN PLATES.

Combined Toning and Fixing Bath.

No. 1 Stock.

Hyposulphite of soda............	20 ounces	or	125 grammes.
Alum (potash alum only)	5 ,,	,,	31 ,,
Sodium sulphate (not sulphite)	14 ,,	,,	88 ,,
Water to................................	1 gallon	,,	1000 c. c.

Dissolve the hypo and alum each in about one quart (250 c. c.) of hot water, mix, and then add sodium sulphate already dissolved, making up to one gallon with remainder of water. This mixture should then be left for some hours for the precipitate to settle, when the clear solution may be poured off or filtered, and is then ready for use. It will keep indefinitely.

No. 2 Stock.

Gold chloride	15 grains	or	4 grammes.
Acetate of lead	64 ,,	,,	18 ,,
Water (distilled)	8 ounces	,,	1000 c. c.

Dissolve the acetate of lead in the water, and add the gold. A heavy precipitate forms in this solution, which should be shaken up when any is to be poured out: it redissolves when added to No. 1 stock solution. For use; Mix 8 oz. of No. 1 with 1 oz. of No. 2. When this bath is used, the prints should *not* be washed *before* toning.

Separate Toning Bath.

Sulphocyanide of ammonium	30 grains	or	4 grammes.
Gold chloride	2½ ,,	,,	0·4 ,,
Water	16 ounces	,,	1000 c. c.

BROMIDE OPALS.

Development.

For black tones the following developer is the one chiefly used; —

Ferrous-oxalate Developer.

Solution 1.

Neutral oxalate of potash	16 ounces	or	320 grammes.
Citric acid	60 grains	,,	3 ,,
Hot water	50 ounces	,,	1000 c. c.

Solution 2.

Protosulphate of iron	4 ounces	or	500 grammes.
Citric acid	¼ ounce	,,	31 ,,
(Or acetic acid, ½ drachm or 8 c. c.)			
Hot water	8 ounces	,,	1000 c. c.

Solution 3.

Bromide of potassium	¼ ounce	or	25 grammes.
Water	10 ounces	,,	1000 c. c.

For development take (when cold) 6 ounces (600 c. c.) of No. 1, and add 1 ounce (100 c. c.) of No. 2 and ½ drachm (6 c. c.) of No. 3.

For warm black tones use the hydroquinone developer, made up as follows: —

Hydroquinone Developer.

Solution 1.

Hydroquinone	½ ounce	or	10 grammes.
Sulphurous acid	¼ ,,	,,	5 ,,
Potassium bromide	60 grains	,,	3 ,,
Water to	50 ounces	,,	1000 c. c.

Solution 2.

Caustic soda	½ ounce	or	10 grammes.
Sodium sulphite	2½ ounces	,,	50 ,,
Water to	50 ,,	,,	1000 c. c.

For use take equal parts of the two solutions. By increasing the exposure and using less of No. 1 solution, still browner images can be obtained. Other developers, such as eikonogen, pyro, rodinal, &c., can also be used.

PAGET PRIZE GELATINO-CHLORIDE PRINTING-OUT PAPER.

ORDINARY OR MATT SURFACE.

Printing should be somewhat darker than the finished print is required.

It should be borne in mind, when toning, that the finished image will be bluer and slightly stronger when dry than in the wet state.

Toning.—The following bath is strongly recommended in preference to any other:—

Sulphocyanide of ammonia ...	30	grains	4 grammes.
Gold chloride	2½	,,	0.4 ,,
Water	16	ounces	1000 c. c.

Before immersion in this toning bath, the prints should be *very thoroughly washed* for at least fifteen minutes in running water. This is necessary to ensure even toning.

If the toning bath be found to tone too quickly, sulphite of soda equal in quantity to the gold used (*i. e.*, 2½ grains for above quantity) may be added. This will make the bath work more slowly, without making any other difference. More or less may be used so as to regulate to speed desired. The sulphite should be kept in a stock solution and added to the bath immediately before use.

In hot weather, if necessary, the print may be soaked in alum (alum, 4 ounces; water, 20 ounces) for five minutes before toning in this bath. Another thorough washing is necessary between the alum and toning baths.

PAGET PRIZE COLLODIO-CHLORIDE PRINTING-OUT PAPER.

Printing should be somewhat darker than the finished print is required; about the same as for our P.O.P., not quite so dark as for albumen.

Keeping.—Both the unprinted pieces of paper and the untoned prints are best kept in a cool place, closely packed together, flat, and under slight pressure. If left loosely exposed to the air, the collodion film may dry and harden, becoming more liable to crack during the toning and subsequent operations. Toning should be done as soon after printing as convenient; the same day, or, at farthest, the next day if possible.

Washing.—Before immersion in the toning bath, the prints should be *very thoroughly washed* for at least five minutes in running water or in three or four changes. If running water from a tap be used, it should not be turned on too violently, as it may tear or injure the film.

Alum.—After washing, it is strongly recommended that the prints be placed in an alum bath (alum, 4 ounces; water, 1 pint) for five minutes, and then washed for a quarter of an hour before toning. The alum has no action on the collodion film, but hardens the prepared paper underneath, and effectually prevents any softening or peeling in the subsequent operations. If the alum be well washed out, toning proceeds even more easily than if alum had not been used.

Toning.—Any of the ordinary toning baths employed for albumen or gelatine may be used, but no bath gives such rich, brilliant tones, either warm or cold, as the sulphocyanide. If a little care be taken to ensure clean dishes and clean fingers, there is no bath more simple or certain. We strongly recommend this bath in preference to any other.

Sulphocyanide of ammonia	30 grains	4 grammes.
Gold chloride	2 ,,	0·3 ,,
Water	16 ounces	1000 c. c.

Tone to exactly the colour desired, judging the prints as they lie in the dish; but it should be borne in mind that the finished image will be slightly bluer and stronger when dry than in the wet state. Wash and fix in

Hyposulphite of soda	3 ounces	150 grammes.
Water	1 pint ,,	1000 c.c.

If this bath be found to tone too quickly, sulphite of soda may be added at the rate of ¼ to ½ grain for every grain of gold used (say 1 grain for above quantity). This will make the bath work more slowly, without making any other difference. More or less may be used, so as to regulate the speed desired. The sulphite should be kept in a stock solution, and added to the bath immediately before use.

Allow at least ten minutes for fixing. Wash thoroughly in running water for at least an hour. Do not on any account wash longer than two hours; never leave in the water all night.

The prints may be damped off on blotting-paper and left to dry, or may be dried quickly in a moderate heat. They should *not* be left to dry *between* plotting-paper unless the latter is known to be pure. Impure blotting-paper makes spots and mottled marks on the prints.

ROUCH'S FORMULÆ.

A. Pyrogallic acid	1 ounce	or	100 grammes.
Sulphite of soda	4 ounces	,,	400 ,,
Water, to make	10 ,,	,,	1000 c. c.

Dissolve the sulphite of soda in hot water, and, when cold, add the pyrogallic acid. Should any portion of the sulphite refuse to dissolve the crystals may be allowed to remain in the bottle.

B. Bromide of ammonium	1 ounce	or	100 grammes.
Water, to make	10 ounces	,,	1000 c. c.

C. Strongest liquor ammoniæ	3 ounces	or	300 c. c.
Water, to make	10 ,,	,,	1000 ,,

In case sulphite of soda be not readily obtainable, the following may be substituted for solution A as above, and used in the same manner:—

Pyrogallic acid	1 ounce	or	100 grammes.
Citric acid	50 grains	,,	11 ,,
Water, to make	10 ounces	,,	1000 c. c.

Dissolve the citric acid first, and then add the pyro.

THE SANDELL FILMS AND PLATES, Ltd., FORMULÆ.

PLATE FORMULA.

Development.—Any developer may be used, but we strongly recommend the following :—

No. 1.

Pyro (heavy crystals recommended)	80 grains or	8 grammes.
Metol	70 „ „	7 „
Potassium metabisulphite	140 „ „	14 „
Potassium bromide	30 „ „	3 „
Water	20 ounces „	1000 c.c.

No. 2.

Sodium sulphite	1 ounce or	50 grammes.
Sodium carbonate	3 ounces „	150 „
Sodium hydrate	60 grains „	6 „
Water	20 ounces „	1000 c.c.

For use, take equal parts of Nos. 1 and 2, varying the proportions if necessary according to exposure.

CRISTOID FILM.

Formalin Bath.

40 per cent. Formaldehyde	½ ounce or	15 c. c.
or		
Schering's photo formalin	2 „ „	60 „
Water, to	1 pint „	600 „

Bath may be used repeatedly.

Developer Stock Solution

Pyrocatechin Merck	1 ounce or	30 grammes.
Potassium bromide	30 grains „	2 „
Sulphite of soda	4 ounces „	120 „
Caustic soda	½ ounce „	15 „
Boiled or distilled water	1 pint „	600 c. c.

Add pyrocatechin after the other salts are completely dissolved. To be kept in well-corked bottle in dark room. For use take 1 in 10 in warm solution and 1 in 7 in cold. Alternative developers are Synthol or Rodinal.

SANDELL LANTERN PLATES.

Black Tones.—Hydrokinone Metol.

No. 1.

Hydrokinone	200 grains or	13 grammes.
Metol	20 „ „	1·5 „
Sulphite soda	3 ounces or	85 „
Bromide potassium	30 grains or	2 „
Citric acid	30 „ „	2 „
Boiled or distilled water to ...	20 ounces or	600 c. c.

No 2.

Carbonate soda cryst.	2 ounces or	56 grammes.
Caustic soda	60 grains or	4 ,,
Boiled or distilled water to	20 ounces or	600 c. c.

Take equal parts of each solution and dilute with twice the quantity of water.

For Warm Tones.—Pyro Ammonia.

No. 1.

Pyro	1 ounce or	28 grammes.
Sulphite soda	3 ,, ,,	85 ,,
Citric acid	120 grains ,,	8 ,,
Boiled or distilled water to	10 ounces ,,	300 c c.

No. 2.

Liquid ammonia ·880	1 ounce or	30 c. c.
Boiled or distilled water to	10 ounces ,,	300 c. c.

No. 3.

Bromide ammonium	1 ounce or 28 grammes.
Boiled or distilled water to	10 ounces.

Take 15 minims of each solution and dilute to one ounce. When the image is well up, add another 15 minims of No. 2.

THOMAS'S FORMULÆ.

LANTERN OR TRANSPARENCY PLATES.

Developing Formulæ.

Black Tones.

No. 1.	Hydroquinone	160 grains or	10 grammes.
	Sodium sulphite	4 ounces ,,	110 ,,
	Citric acid	60 grains ,,	4 ,,
	Potassium bromide	160 ,, ,,	10 ,,
	Water to	20 ounces ,,	560 c. c.
No. 2.	Sodium hydrate	160 grains or	10 grammes.
	Water to	20 ounces ,,	560 c. c.

Take equal parts of each solution, and development should be completed in three to four minutes. The plates should be somewhat overdeveloped, as they lose density in fixing.

Cold Tones.

No. 1.	Pyrogallic acid	1 ounce or	28 grammes.
	Metabisulphite of soda	1 ,, ,,	28 ,,
	Water to	100 ounces ,,	2830 c. c.
No. 2.	Washing soda	6 ounces or	170 grammes.
	Potassium bromide	20 grains ,,	1·3 ,,
	Water to	100 ounces ,,	2830 c. c.

Take equal parts of each solution, and development should be completed in five to seven minutes. Slightly over-develop to allow for loss in fixing.

Purple Tones.

No. 1.	Pyrogallic acid	1 ounce	or	28 grammes.
	Metabisulphite of soda	1 ,,	,,	28 ,,
	Water to	80 ounces	,,	2250 c. c.
No 2.	Ammonium bromide	8 ounces	or	225 grammes.
	Liq. ammoniæ ·880	4 ,,	,,	110 c. c.
	Water to	80 ,,	,,	2250 ,,

Use equal parts of each solution.

This developer allows great latitude in exposure, and takes from three to twelve minutes to develop, according to the amount of exposure given.

When using this developer, the image will appear buried and lacking in density if examined by ruby light, but, when fixed, will be fully dense. and the deposit will appear opaque by reflected light, and purple by transmitted light, improving in colour when dry.

Fixing Bath.

Hyposulphite of soda	4 ounces	or	110 grammes.
Ten per cent. solution of metabisulphite of soda	1 ounce	,,	28 c. c.
Water to	20 ounces	,,	560 ,,

PYRO AND SODA DEVELOPER.

No. 1.	Pyrogallic acid	1 ounce	or	12·5 grammes.
	Metabisulphite of soda	1 ,,	,,	12·5 ,,
	Water to	80 ounces	,,	1000 c. c.
No. 2.	Carbonate of soda (washing soda)	6 ounces	or	75 grammes.
	Water	80 ,,	,,	1000 c. c.

For use, take equal parts of Nos. 1 and 2. For full exposure and in hot weather, 2 to 5 drops of a ten per cent. solution of potassium bromide may be added to each ounce. For under-exposure and isochromatic emulsions, this developer may be still further diluted.

Fixing Bath.

Hyposulphite of soda	1 pound	or	200 grammes.
Water to make	80 ounces	,,	1000 c. c.

WRATTEN & WAINWRIGHT'S FORMULÆ.

DEVELOPING FORMULÆ.

Ten per cent. Pyro and Ammonia.

A.	Liquor ammoniæ	1 ounce	or	100 c. c.
	Bromide potassium	110 grains	,,	22 grammes.
	Water	10 ounces	,,	1000 c. c.
B.	Pyro	1 ounce	or	100 grammes.
	Citric acid	60 grains	,,	12 ,,
	Or sulphuric acid	½ drachm	,,	6 c. c.
	Water	10 ounces	,,	1000 ,,

For Instantaneous and Ordinary take from 60 (3 c. c.) to 90 minims (5 c. c.) and for Drop Shutter 90 minims (5 c. c.) of Solution B, dilute with from 2 to 4 ounces (60 to 120 c. c.) of water, and add 100 minims (6 c. c.) of Solution A.

It is better to add Solution A by instalments as development proceeds, unless the exposure is known to be either insufficient or quite accurate, in which cases it may be in one quantity.

The addition of 2 ounces (200 grammes) sulphite of soda to Solution B retards discoloration and improves the tone of the negative, but slightly prolongs the operation of development.

PYRO SODA.

We recommend this developer for studio and hand-camera work.

No. 1.	Sulphite soda	6 ounces	or	75	grammes.
	Water	80 ,,	,,	1000	c. c.
	Sulphuric acid or citric acid	1 drachm	,,	1·5	,,
	Pyro	1 ounce	,,	13	grammes.
No. 2.	Soda carbonate	6 ounces	or	75	grammes.
	Water	80 ,,	,,	1000	c. c.

For use, take equal parts of Nos. 1 and 2.

The best printing results in hand camera work may be obtained by developing with the above developer or the pyro acetone, and diluting with from 1 to 1½ times its bulk with water. Time from 10 to 20 minutes; without dilution, 3 to 5 minutes.

METOL.

A.	Metol	50 grains	or	10 grammes.
	Water	10 ounces	,,	1000 c. c.
	When dissolved, add			
	Soda sulphite	1 ounce	,,	100 grammes.
B.	Soda carbonate	2 ounces	or	200 grammes.
	Or potass. carbonate	1 ounce	,,	100 ,,
	Water	10 ounces	,,	1000 c. c.

C. *Ten per cent. Potass. Bromide Solution.*

Potass. bromide	1 ounce or 100 grammes.
Water	10 ounces ,, 1000 c.c.

Mix 3 parts A with 1 part B, dilute with an equal bulk of water, and add 20 minims (1·5 c. c.) ten per cent. bromide solution C.

If more density and contrast be required, use the solution more concentrated, dilution giving softness according to its degree.

PYRO ACETONE.

No. 1.—Same as pyro soda No. 1.

No. 2.—Acetone, 10 ounces or 250 c. c.; water, 40 ounces or 1000 c. c.

For use, take equal parts Nos. 1 and 2; or, for more contrast, No. 1, 2 parts; No. 2, 1 part.

For over-exposure add ten per cent. bromide solution from 5 minims (·3 c. c.) upwards according to necessity.

For use with the London Drop-shutter Special always add 5 minims (·3 c. c.) of ten per cent. bromide solution *before* application.

This developer gives reddish-brown tones, is controllable by the addition of bromide, produces a good even printing density, and is excellent for under-exposure.

The total time of development is about the same as with pyro soda, although the image makes a quicker appearance.

It does not soil the hands.

Rodinal used in the proportion of 1 to 25 yields brilliant results, its applicability is very comprehensive, suiting nearly all subjects.

Temperature of water and solutions should be about 60° F. or 15 C.

Fixing.—Either a plain A or an acid B fixing bath may be used, giving a brown or a blackish tint respectively after pyro-ammonia development.

A.	Hyposulphite soda	4 ounces or 200 grammes.
	Water	20 ,, ,, 1000 c. c.
B.	Hyposulphite soda	5 ounces or 250 grammes.
	Water	20 ,, ,, 1000 c. c.
	Sulphite soda	1 ounce ,, 50 grammes.

When dissolved, add slowly, stirring all the time,

Sulphuric acid	1 drachm or 6 c. c.

Formalin will be found very useful during hot or thundery weather in preventing decomposition during prolonged washing, and should be used according to maker's directions.

N.B.—The equivalents of English and French measures above given are approximate.

WELLINGTON & WARD'S FORMULÆ.

CELLULOID FILMS.

Any developer may be employed, but the following is recommended for normal exposures :—

Pyro and Soda.

No. 1.

Pyrogallic acid	1 ounce.
Sulphite of soda	2 ounces.
Citric acid	40 grains.
Water to	10 ounces.

No. 2.

Carbonate of soda	8 ounces.
Sulphite of soda	8 ,,
Water to	80 ,,

Take 1 ounce No. 2; 1 drachm No. 1; water, 1 ounce.

For over-exposed negatives, add 10 to 20 drops of the following, in 4 ounces of developer, according to amount of over-exposure :—

Bromide potass.	1 ounce.
Water	10 ounces.

This restrainer is to be used only in case of over-exposure.

THE WELLINGTON PLATINO MATT BROMIDE PAPER.

Having made the exposure, immerse the paper face upwards in water until thoroughly soaked, then drain off and immediately flow the developer evenly over the surface. Insufficient soaking is the cause of air bubbles, producing white spots. (For small prints it is preferable to flow the developer over the dry exposed paper.)

We advocate Amidol as being the most reliable developer for general purposes, although any other may be used.

Amidol Developer.

Amidol	50 grains.
Sulphite soda	650 ,,
Potass. bromide	10 ,,
Water	20 ounces.

This developer should be used within three days of mixing.

Metol Developer.

Metol	50 grains.
Hydrokinone	15 ,,
Sulphite of soda	500 ,,
Potass. bromide	10 ,,
Potass. carbonate	100 ,,
Water	20 ounces.

Dissolve the Metol in the water first. This developer keeps well.

The same solutions may be used for two or more prints in succession.

As soon as development is complete (which for a normal exposure should take about two minutes), the print should be transferred, without washing, to either of the following fixing baths, where it should remain for at least five minutes :

Hyposulphite of soda	4 ounces.
Water	20 ,,

Stock Solution.

Sulphite of soda	1 lb.
Sulphuric or acetic acid	2 ounces.
Water to make	80 ,,

Acid Fixing Bath.

Hyposulphite of soda	2 ounces.
Stock acid sulphite solution as above	1 ,,
Water	20 ,,

NOTE.—Thoroughly wash after fixing.

"WELLINGTON" S.C.P. (SLOW CONTACT PAPER).

A Gaslight Developing Paper.

The packet must be opened in gaslight or very subdued daylight, and the sheets may be placed in the printing frame a few feet from the source of light.

Exposure.—With an average negative, an exposure of one to three minutes at a distance of six inches from an ordinary fish-tail gas burner; or, if an ordinary lamp is used, three minutes should be sufficient ; or two to five seconds if daylight is the medium of light employed.

Developing.—Place the printed sheet in a clean dish, then flow quickly and evenly over the surface the developer as given below. If large sizes are used, it is better to soak the paper for a few seconds before developing.

Metol and Hydrokinone.

Metol	10 grains.
Hydrokinone	30 ,,
Sulphite of Soda (cryst.)	350 ,,
Carbonate of Soda (cryst.)	350 ,,
Water	10 ounces.
Bromide of Potassium	3 grains.

Dissolve the above in order named.

(This developer keeps indefinitely in well stoppered bottles.)

Using the above developer exactly as given, fine blue-black tones may be obtained. If softer results are required, expose the print a little longer and dilute the developer with a further 10 ounces of water.

For very brilliant blue-black tones we recommend the following:—

Amidol Developer.

Sulphite of soda	500 grains.
Amidol	50 ,,
Bromide of potassium	2 ,,
Water	10 ounces.

This developer only keeps three days; after that time it should be discarded and fresh made up.

Fixing.—When development is considered complete, rinse for a second and place in the hypo bath as follows. See that the print is submerged during the process of fixation, which should take about five to ten minutes.

Fixing Bath.

Hyposulphite of soda	4 ounces.
Water	20 ,,

THE WELLINGTON P.O.P.

(Special for sulphocyanide bath only.)

Well wash the prints previous to immersion in the toning bath.

Ammonium sulphocyanide	20 grains.
Gold chloride	2 ,,
Water	16 ounces.

The tone is to be judged entirely by the surface, and not by looking through the print. Always undertone, as the finished print becomes very much colder when dry. Fix in hyposulphite of soda, 1 ounce to 1 pint of water, allowing 15 minutes for complete fixation.

ORDINARY WELLINGTON P.O.P.

The prints must be thoroughly well washed, for at least 10 minutes, in many changes of water previous to toning.

Toning.—The following baths are equally good for obtaining most lovely warm or purple tones :—

Formate Toning Bath.

Sodium Formate	15 grains.
Sodium Bicarbonate	3 ,,
Gold Chloride	2 ,,
Water (distilled)	40 ounces.

Print rather darkly, wash the prints well to thoroughly remove the free chloride. The quantity given above is sufficient to tone two full quire sheets of paper, and should be made up half-an-hour before using. It will not keep.

Caution.—Do not overtone. Well rinse and fix. The Alum bath is only necessary when the prints have to be squeegeed on to glass; the Formate and Phosphate baths have no softening effect whatever on the gelatine, as is the case with Sulphocyanide, and it is most important to keep the bath slightly alkaline with Bicarbonate of Soda, as it gets acid with use, owing to the formation of Formic Acid.

Phosphate Toning Bath.

Phosphate of Soda	60 grains.
Gold Chloride	2 ,,
Water	40 ounces.

This bath should be allowed to stand one hour before using; it will not keep. The above quantity is sufficient for 24 half-plates.

Caution.—Care should be taken not to overtone, as prints become darker when dry. Judge the tone by the surface of the print and not by looking through it. For warm tones the prints must be decidedly red in leaving the toning bath; for purple tones there should be still a slight trace of red left.

The prints must now be well washed and then fixed in the following bath, where they should remain for not less than 10 minutes.

Fixing Bath.

Sodium hyposulphite	2 ounces.
Water	20 ,,

After fixing, wash thoroughly in running water for at least one hour. The prints may then be hung up to dry by means of clips, or to obtain a highly-glazed surface, squeegee them on to a ferrotype plate and there allow to remain until dry. On no account should they be placed between blotting-paper.

“Wellington” Self-Toning Paper.

Print as for P.O.P.

Immerse prints direct, without washing, for 20 to 30 seconds, in the following:—

Ammonium sulphocyanide	20 grains.
Water	20 ounces.

Wash for five minutes in running water, and fix in—

Hypo	3 ounces.
Water	20 ,,

After which wash thoroughly and hang up to dry.

For warm brown tones, simply place in fixing bath as under for 15 minutes—

Hypo	2 ounces.
Water	20 ,,

Wash and dry as above.

JOHN J. GRIFFIN & SONS, Ltd., LONDON.

Carbona P.O.P.

Red Crayon Tones.

These are obtained from vigorous negatives only. Thin negatives will give a colour inclined to yellow. Do not print too deeply. Wash as usual, then fix for 10 minutes in hypo 1 ounce, water 20 ounces; then wash and dry as usual.

Sepia Tones.

Wash as usual; then place the prints in toning bath, one or two at a time. The toning action is very rapid.

Chloro-platinite of potassium	3 grains.
Citric acid	80 ,,
Water	10 ounces.

For warm sepia tones, remove in 15 seconds; for rich olive-purple tones, remove after 2 to 4 minutes. Over-toning produces stained high lights. Afterwards rinse and fix in hypo 1 ounce, water 20 ounces, for 10 minutes.

Other baths which give excellent results are the following:—

Sulphocyanide and Gold.

Gold Chloride	1 grain.
Sulphocyanide of Ammonium	15 grains.
Water	10 ounces.

Borax and Acetate.

Gold Chloride	1 grain.
Borax	25 grains.
Acetate Soda	50 ,,
Water	10 ounces.

Combined Toning-Fixing.

Distilled Water	35 ounces.
Hypo	4½ ,,
Alum	¾ ,,
Ammonium Sulphocyanide	150 grains.
Sodium Chloride	1½ ounces.

After a short time the liquid gets thick. It must then be left for several days and the clear liquid finally poured off. Then add to the clear solution—

Gold Chloride	15 grains.
Water	3½ ounces.

GLYCIA P.O.P.

Toning Baths.

Sulphocyanide Bath.

Gold chloride	1 grain.
Sulphocyanide of ammonia	15 grains.
Water	10 ounces.

Borax Bath.

Gold chloride	1 grain.
Borax	6 grains.
Water	10 ounces.

Both baths tone evenly and quickly. The borax bath tends to produce warmer tones, while the sulphocyanide bath is best for purples.

Mix your bath up for the exact number of prints you are about to tone.

Combined Toning and Fixing Bath.

Lead acetate	60 grains	or	6 grms.
Sodium acetate	20 ,,	,,	2 ,,
Hypo	2 ounces	,,	90 ,,
Sodium carbonate	20 grains	,,	2 ,,
Powdered alum	60 ,,	,,	6 ,,
Gold chloride	2 ,,	,,	0·2 ,,
Water up to	16 ounces	,,	700 c.c.

Mix in the order stated, and filter. The bath may be used at once, but works better if allowed to stand for twenty-four hours.

Developing-Out Bath.

This method is valuable during the dull weather, when printing-out is slow. It is also useful for underprinted proofs, due to slips in the frame or miscalculations, The exact depth of printing is not important, except that detail in the high lights must be just visible.

Developing Bath for Partly-Printed Proofs.

Metol	5 grains.
Pyro	5 „
Acetic acid glacial	2 drachms.
Water	10 ounces.

GRIFFIN'S BROMIDE PAPER FOR ENLARGING.

Development.—To develop the image, first plunge the paper in clean water, place at the bottom of a clean porcelain dish, and apply evenly any of the following developers:—

Amidol.

Amidol	70 grains.
Sodium sulphite, cryst.	650 „
Potassium bromide	15 „
Water	20 ounces.

Metol-Quinol.

Metol	8 grains.
Hydrokinone	30 „
Sodium sulphite, cryst.	240 „
Sodium carbonate, cryst.	360 „
Bromide of potassium	4 „
Water	25 ounces.

If the whites of the print are greyish, or the shadows lack richness, increase the amount of bromide of potassium.

Fixing.—After development, rinse print in water, and fix in

Soda hyposulphite	1 ounce
Water	10 ounces

for 10 minutes; then wash for half-an-hour in running water.

Permanent Sepia Tones.—These may be produced by immersing the fixed print in

Soda hyposulphite	10 ounces.
Ground alum	2 „
Boiling water	50 „

The bath must be kept hot (about 130° Fahr.), when the prints will tone in from 10 to 30 minutes.

The following toning baths may be used for producing very beautiful sepia and blue prints, but they are not necessarily permanent.

Toning Bath for Sepia Prints.

Potassium citrate,	10 per cent.	solution,	take	1 ounce.
Copper sulphate,	„	„	„	70 minims.
Potassium ferri cyanide,	„	„	„	60 „

Toning Bath for Blue Prints.

Ammonia citrate of iron,	10 p. c.	solution,	take	2 drachms.
Potassium ferri cyanide	„	„	„	2 „
Water			„	40 „

VELOX PAPERS.

Developer.

(Dissolve chemicals in the order named.)

Water	10 ounces.
Metol	7 grains.
Hydroquinone	30 ,,
Sulphite soda (desiccated)	110 ,,
Carbonate soda (desiccated)	200 ,,
10 per cent. solution bromide potassium	40 drops.

This solution will keep indefinitely if placed in bottles filled to the neck and tightly corked.

It should be used full strength for "Regular," but can be diluted with equal parts of water when Special Velox is developed.

Acid Fixing Bath.

(Dissolve chemicals in the order named.)

Water	64 ounces.
Hyposulphite of soda	16 ,,

After the above bath has been made, add to it the following hardening solution.

Water	5 ounces.
Sulphite soda (desiccated)	¼ ,,
Glacial acetic acid, 50 per cent	1½ ,,
Powdered alum	½ ,,

This solution can be used repeatedly and one pint of it will fix at least one-half gross 4 × 5 prints.

If sulphite and carbonate sodas in crystal form are substituted for desiccated, double the quantities mentioned should be used. (Note—In England, Canada, or wherever the British Pharmacopœia is official, use 150 grains instead of 200 grains of desiccated sodium carbonate.)

"GASLYT" LANTERN PLATES.

Developing Baths.

For Black Tones.

Water	8 ounces.
Metol	4 grains.
Sodium sulphite crystals	75 ,,
Hydroquinone	16 ,,
Sodium carbonate crystal	280 ,,
Potassium bromide	8 ,,

For Warm or Sepia Tones.

Solution (as for black tones)	1 ounce.
Water	2 ,,

Potassium bromide solution, 10 per cent., 10 drops, or 1 grain of the solid substance.

Fixing Bath.

Stock Solution.

Sulphite of soda	4 ounces
Citric acid	½ ounce.
Water, to make	20 ounces.

To prepare the fixing bath, take stock solution as above 6 drachms, soda hyposulphite 4 ounces, water 20 ounces.

A. & M. ZIMMERMANN'S SELTONA SELF-TONING PAPER.

DIRECTIONS FOR USE.

Print as for P.O.P.; considerably deeper than the finished print is to be.

For Warm Brown Tones.

Place the print, *without* previous washing, in the fixing bath as follows:—

Hypo	1 oz.
Water	15 ozs.

Fix for about ten minutes, then wash for one hour in running water or 8—10 changes.

For Purple and Blue Tones.

Place the prints, *without* previous washing, for 7—10 minutes in the following:—

Common Salt, ¼ oz. (or a good teaspoonful to ½ pint water)
Water.........12 ozs.

Rinse in clean water and fix as above.

A. & M. ZIMMERMANN'S LETO PLATINO-MATT.

FOR BROWN-BLACK AND WARM-BLACK TONES.

Printing.—Print very deeply, until the shadows develop a distinct bronze tinge, as the prints lose considerably during the toning processes.

Washing.—It is most important that this should be done thoroughly. Wash in several changes until the last washing water is perfectly clear.

Toning.—The prints are first partly toned in the following gold bath. Toning must not be carried on too far, but only until the prints seem to have changed colour. A long immersion will yield blue-black and a short immersion brown-black tones in the subsequent platinum bath.

Shortly before use only, make up as follows:—

Water	17 ounces.
Acetate of soda	1 ounce.
Gold chloride	1 gr.

After toning, wash for a minute or two, and continue in the following platinum bath, until the desired effect has been obtained. (This bath may be used over and over again until exhausted, when a fresh bath must be made up.)

Water	9 ounces.
Phosphoric acid	2 drachms.
Chloroplatinite of potash	7½ grs.

Then wash in 2—3 changes of water.

Fix for 10 minutes in hypo 1 ounce; water 20 ounces.

Final Washing.—For at least one hour in running water or 8—10 changes.

RICH SEPIA AND RED-BROWN TONES.

Rich sepia and red-brown tones are obtained by diluting the above solutions with an equal quantity of water, and proceeding in the same way as for black tones.

Toning in the gold bath must only be carried on until the high lights are clear.

In the platinum bath the prints must only be immersed for a few moments and then fixed as usual.

Printing must not be carried on too far.

DARK SEPIA TONES (IN SINGLE BATH).

Dark sepia tones can be obtained by using the platinum bath as given above, without the gold bath, but 10—12 ozs. of water should be taken in place of the 9 oz.

Printing must not be carried on too far.

THE ILFORD FORMULÆ.

KALONA—THE ILFORD SELF-TONING PAPER.

The printing is done in the same way and to the same depth as with Ilford P.O.P.

The prints are then without previous washing slipped rapidly one by one face upwards into the following solution:—

Alum (powdered)	1½ ounces.
Ammonium sulphocyanide	20 grains.
Water	20 ounces

They must be constantly turned over in the solution for five minutes to allow of an equal action on all parts. With very little practice a large number can be manipulated at the same time. The prints should next be washed for ten minutes in running water or repeated changes and fixed for ten minutes in a solution of

Hypo	3 ounces.
Water	20 ounces.

They are then finally washed for two hours in the same way as Ilford P.O.P. and may be finished either with their natural surface or the glossy variety may be burnished or enamelled on glass or ferrotype plates.

Mounting is carried out with starch paste exactly as with Ilford P.O.P.

Imperfect washing between the alum and sulphocyanide solution and the fixing bath leads to disastrous results as the beautifully rich tone of the paper is destroyed and uneven bluish-gray or greenish stains appear on those parts of the prints which contained traces of the alum solution when they were placed in the hypo. Taking a mass of prints from a solution, throwing them in a heap into water and allowing them to remain there for the prescribed time, even though the water be running, does not constitute washing. The prints must be thoroughly separated, never be allowed to adhere one to another or to the bottom of the dish and be kept on the move the whole time. The water must be frequently changed so that the prints may be really chemically clean before they are to be fixed.

The prints should not be kept longer in the solutions than the times given, nor should the quantity of sulphocyanide be increased. Either departure from the instructions given has a tendency to produce pinky half-tones. The process of toning need not be watched. It is only necessary to make up the solutions according to the formulæ given, and time the operations as directed. The alum and sulphocyanide solution may be used repeatedly, it gives warmer tones as it becomes exhausted.

The full quantity of sulphocyanide must be used, and if this chemical, which is very deliquescent, be at all damp so that its weight is increased by the moisture, this must be allowed for and the quantity be proportionately increased.

It will be found convenient to make up the bath from the following stock-solutions, which will keep indefinitely:—

No. 1.

Alum (powdered)	8 ounces.
Water	100 ounces.

No. 2.

Ammonium sulphocyanide	100 grains.
Water	10 ounces.

For use mix 18 ounces of No. 1 with 2 ounces of No. 2.

It is essential to work with clean hands and dishes.

In tropical climates the following may be used instead of the ordinary formula:—

Ammonium sulphocyanide	20 grains.
Chrome alum	20 grains.
Water	20 ounces.

The colour of the prints is not affected.

A fresh fixing bath should be used for each batch of prints, but care must be taken to have all the solutions as nearly alike in temperature as possible.

The alum and sulphocyanide solution *may* be omitted and the prints be put into a solution of

Common salt	1 ounce.
Water	20 ounces.

for 5 minutes and then fixed, but the resulting tone is warmer than that obtained by the use of the sulphocyanide. It is however permanent. Prints treated in this way are not so suitable for enamelling.

Kalona post cards (Matt only) are treated in exactly the same way as the paper.

SOLUBILITY OF THE SILVER HALOIDS.

By E. VALENTA.

In the *Royal Photographic Society's Journal* the following table, the result of a series of experiments, was given.

Solvent.	Concentration.	100 g. of solution can dissolve in grammes.			Remarks.
		Ag Cl.	Ag Br.	Ag I.	
Sodium hyposulphite	1 : 100	0·40	0·35	0·03	The estimations were made at 20° C.
,,	5 : 100	2·00	1·90	0·15	
,,	10 : 100	4·10	3·50	0·30	
,,	15 : 100	5·50	4·20	0·40	
,,	20 : 100	6·10	5·80	0·60	
Ammonium hyposulphite	1 : 100	0·57	—	—	For bromide and iodide of silver similar results were obtained as with sodium hyposulphite.
,,	5 : 100	1·32	—	—	
,,	10 : 100	3·92	—	—	
Sodium sulphite	10 : 100	0·44	0·04	0·01	
,,	20 : 100	0·95	0·03	0·02	
Ammonium sulphite	10 : 100		traces		
Ammonium carbonate	10 : 100	0·05	—	—	
Ammonia	3%	1·40	—	—	
,,	15%	7·58	—	—	
Magnesium chloride	50 : 100	0·50	—	—	
Potassium cyanide	5 : 100	2·75	6·55	8·23	25° C.
Ammonium sulphocyanide	5 : 100	0·08	0·21	0·02	23° C.
,,	10 : 100	0·54	2·04	0·08	
,,	15 : 100	2·88	5·30	0·13	
Potassium sulphocyanide	10 : 100	0·11	0·73	—	25° C.
Calcium sulphocyanide	10 : 100	0·15	0·53	0.03	
Barium sulphocyanide	10 : 100	0·20	0·35	0·02	
Aluminium sulphocyanide	10 : 100	2·02	4·50	0·02	
Thiocarbamide	10 : 100	0·83	1·87	0·79	25° C.
Thiosinamin	1 : 100	0·40	0·08	0·008	
,,	5 : 100	1·90	0·35	0·05	
,,	10 : 100	3·90	0·72	0·09	

A TABLE OF ATOMIC WEIGHTS OF SEVENTY-FOUR ELEMENTS.

By T. W. Richards,

From the "American Chemical Journal."

NAME.	Symbol.	Atomic Weight.
Aluminium	Al	27·1
Antimony	Sb	120·0
Argon	A	39·9 ?
Arsenic	As	75·0
Barium	Ba	137·43
Beryllium	Be=Gl	9·1
Bismuth	Bi	208·0
Boron	B	10·95
Bromine	Br	79·955
Cadmium	Cd	112·3
Cæsium	Cs	132·9
Calcium	Ca	40·0
Carbon	C	12·001
Cerium	Ce	140·0
Chlorine	Cl	35·455
Chromium	Cr	52·14
Cobalt	Co	59·00
Columbium	Cb=Nb	94·0
Copper	Cu	63·60
"Didymium"	Nd + Pr	142 +
Erbium	Er	166·0
Fluorine	F	19·05
Gadolinium	Gd	156·0 ?
Gallium	Ga	70·0
Germanium	Ge	72·5
Glucinum	Gl=Be	9·1
Gold	Au	197·3
Helium	He	4·0 ?
Hydrogen	H	1·0075
Indium	In	114·0
Iodine	I	126·85
Iridium	Ir	193·0
Iron	Fe	56·0
Lanthanum	La	138·5
Lead	Pb	206·92
Lithium	Li	7.03
Magnesium	Mg	24·86
Manganese	Mn	55·02
Mercury	Hg	200·0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight.
Molybdenum	Mo	96·0
Neodymium	Nd	143·6
Nickel	Ni	58·70
Niobium	Nb = Cb	94·0
Nitrogen	N	14·045
Osmium	Os	190·8
Oxygen (Standard)	O	16·000
Palladium	Pd	106·5
Phosphorus	P	31·0
Platinum	Pt	195·2
Potassium	K	39·140
Praseodymium	Pr	140·5
Rhodium	Rh	103·0
Rubidium	Rb	85·44
Ruthenium	Ru	101·7
Samarium	Sm	150·0
Scandium	Sc	44·0
Selenium	Se	79·0
Silicon	Si	28·4
Silver	Ag	107·93
Sodium	Na	23·050
Strontium	Sr	87·68
Sulphur	S	32·065
Tantalum	Ta	183·0
Tellurium	Te	127·5
Terbium	Tb	160·0
Thallium	Tl	204·15
Thorium	Th	233·0
Thulium	Tu	170·0 ?
Tin	Sn	119·0
Titanium	Ti	48·17
Tungsten	W	184·4
Uranium	U	240·0
Vanadium	U	51·4
Ytterbium	Yb	173·0
Yttrium	Yt	89·0
	Zn	65·40
Zirconium	Zr	90·5

ORANGE CAMERA CLUB.

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

NAME.	SYMBOL.	
Acetone	$CH_3\ CO\ CH_3$	58
Acid, Acetic	$CH_3\ COOH$	60
,, Boracic	$H_3\ BO_3$	62
,, Citric	$C_6\ H_8\ O_7+Aq$	210
,, Formic	$H\ COOH$	46
,, Gallic	$C_6\ H_2\ (OH)_3\ COOH$	188
,, Hydriodic	HI	128
,, Hydrobromic	$H\ Br$	81
,, Hydrochloric	$H\ Cl$	36·5
,, Hydrocyanic	$H\ CN$	27
,, Hydrosulphuric	$H_2\ S$	34
,, Nitric	$H\ NO_3$	63
,, Oxalic	$(COOH)_2+2\ Aq$	126
,, Pyrogallic	$C_6\ H_3\ (OH)_3$	126
,, Sulphuric	$H_2\ SO_4$	98
,, Sulphurous	$H_2\ SO_3$	82
,, Tannic	$C_{14}\ H_{10}\ O_9$	322
,, Tartaric	$C_2\ H_2\ OH_2\ COH)$	133
Alcohol (Methyl)	$CH_3\ OH$	32
,, (Ethyl)	$C_2\ H_5\ OH$	46
Alum (Chrome)	$K\ Cr\ (SO_4)_2\ 12\ Aq$	499·3
,, Potash	$K\ Al\ (SO_4)_2+12\ Aq$	474·5
Amidol	$C_6\ H_3\ OH\ (NH_2)_2\ (H\ Cl)_2$	196
Ammonium, Bichromate	$(NH_4)_2\ Cr\ _2\ O_7$	53
,, Bromide	$NH_4\ Br$	298
,, Chloride	$NH_4\ Cl$	53 5
,, Iodide	$NH_4\ I$	145
,, Nitrate	$NH_4\ NO_3$	80
,, Oxalate	$(\ \ H_4)_2\ C\ O_4$	124
,, Sulphide	$NH_4,\ HS$	51
,, Sulphocyanide	$NH_4,\ CNS$	76
Barium, Bromide	$Ba\ Br_2+2\ Aq$	333
,, Chloride	$Ba\ Cl_2+2\ Aq$	244
,, Iodide	$Ba\ I_2+2\ Aq$	427
,, Nitrate	$Ba,\ (NO_3)_2$	261
Benzole	$C_6\ H_6$	78
Cadmium, Bromide	$Cd\ Br_2+4\ Aq$	344
,, Chloride	$Cd\ Cl_2+2\ Aq$	219
,, Iodide	$Cd\ I_2$	366
Calcium, Bromide (Cryst.)	$Ca\ Br_2+4\ Aq$	272
,, Chloride (Cryst.)	$Ca\ C+6Aq$	219
,, Iodide	$Ca\ I_2$	294
Copper, Bromide	$Cu\ Br_2$	223·5
,, Chloride	$Cu\ Cl_2+2\ Aq$	170 5
,, Sulphate	$Cu\ SO\ +5\ Aq$	249·5

ORANGE CAMERA CLUB.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	
Eikonogen	$C_{10} H_5 OH (NH_2)_2 (H Cl)_2$	247
Formaline	$H CHO$	30
Glycerine	$C_3 H_5 (OH)_3$	92
Gold, Chloride	$Au Cl_3 + 2 Aq$	339·2
Hydroquinone	$C_6 H_4 (OH)_2$	110
Iridium, Perchloride	$Ir Cl_4$	335
Iron, Chloride (ferrous)	$Fe Cl_2 + 4 Aq$	199
,, ,, (ferric)	$Fe_2 Cl_6$	325
,, Citrate	$Fe_2 (C_6 H_5 O_7)_2$	598
,, Iodide	$Fe I_2 + 4 Aq$	382
,, Oxalate (ferrous)	$Fe C_2 O_4$	144
,, ,, (ferric)	$Fe_2 C_2 O_4)_3$	376
,, Sulphate (ferrous)	$Fe SO_4 + 7 Aq$	278
,, ,, (ferric)	$Fe_2 (SO_4)_3$	400
,, Ammonia-sulphate	$Fe SO_4 (NH_4)_2 SO_4 + 6 Aq$	392
Lead, Acetate	$Pb (C_2 H_3 O_2)_2 + 3 Aq$	379
,, Nitrate	$Pb (NO_3)_2$	331
Lithium, Bromide	$Li Br$	87
,, Chloride	$Li Cl$	42.5
,, Iodide	$Li I$	134
Magnesium, Bromide	$Mg Br_2$	184
,, Chloride	$Mg Cl_2 + 6 Aq$	203
,, Iodide	$Mg I_2$	278
Mercury, Chloride (Mercuric)	$Hg Cl_2$	271
Metol	$C_6 H_4 OH CH_3 NH (H_2 SO_4)_2$	349
Para-amidophenol	$C_6 H_4 OH NH_2 HCl$	145
Platinum, Chloride (Platinic)	$Pt Cl_4 + 8 Aq$	483·4
,, ,, (Platinous)	$Pt Cl_2$	268·4
Potassium, Acetate	$K_2 C_2 H_3 O_2$	137
,, Bichromate	$K_2 Cr_2 O_7$	295
,, Bromide	$K Br$	119·1
,, Carbonate	$K_2 CO_3 + 2 Aq$	174
,, Chlorate	$K Cl O_3$	122·5
,, Chloride	$K Cl$	74·5
,, Citrate	$K_3 C_6 H_5 O_7 + Aq$	324·3
,, Cyanide	$K C N$	65
,, Ferridcyanide	$K_6 Fe_2 Cy_{12}$	658
,, Ferrocyanide	$K_4 Fe Cy_6 + 3 Aq$	422
,, Hydrate	$K OH$	56·1
,, Iodide	$K I$	166
,, Nitrate	$K NO_3$	101
,, Oxalate	$K C_2 O_4 + Aq$	235
,, Permanganate	$K_2 Mn_2 O_8$	316
,, Platino-chloride	$(K_2 Pt Cl_4)$	342·1
,, Sulphocyanide	$K Cy S$	97
Silver, Acetate	$Ag C_2 H_3 O_2$	167
,, Bromide	$Ag Br$	188

TABLES OF SYMBOLS, &c.—Continued.

NAME.	SYMBOL.	
Silver, Carbonate	$Ag_2 CO_3$	276
,, Chloride	$Ag Cl$	143·5
,, Citrate	$Ag_3 C_6 H_5 O_7$	513
,, Fluoride	$Ag Fl$	127
,, Iodide	$Ag I$	235
,, Nitrate	$Ag NO_3$	170
,, Oxalate	$Ag_2 C_2 O_4$	304
,, Oxide	$Ag_2 O$	232
,, Sulphide	$Ag_2 S$	248
Sodium, Acetate	$Na C_2 H_3 O_2 + 3 Aq$	136
,, Biborate (Borax)	$Na_2 B_4 O_7 + 10 Aq$	382
,, Bichromate	$Na_2 Cr_2 O_7 + 2 Aq$	299
,, Bromide	$Na Br + 4 Aq$	175
,, Carbonate (Cryst.)	$Na_2 CO_3 + 10 Aq$	286
,, Chloride	$Na Cl$	58·5
,, Hydrate	$Na H O$	40
,, Hyposulphite (Cryst.)	$Na_2 S_2 O_3 + 5 Aq$	248
,, Iodide	$Na I + 4 Aq$	222
,, Sulphite	$Na_2 SO_3 + 7 Aq$	252
Strontium, Bromide	$Sr Br_2$	247·5
,, Chloride	$Sr Cl_2$	158·5
,, Iodide	$Sr I_2$	341·5
Tin, Chloride (Stannous)	$Sn Cl_2 + 2 Aq$	225
,, ,, Stannic	$Sn Cl_4$	260
Uranium, Bromide	$U Br_2 + 4 Aq$	352
,, Nitrate	$U_2 O_3 (NO_3)_2 + 6 Aq$	504
Zinc, Bromide	$Zn Br_2$	225·2
,, Chloride	$Zn Cl_2$	136·2
,, Iodide	$Zn I_2$	319·2

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling		
Acid, Boracic (Anhydrous)..	47·01	...	2·13	soluble
„ „ (Cryst.).........	25·66	3·0	3·9	sol. in 6 parts @ 60°
„ Citric	0·75	0·5	133·0	sol. in 1·15 pt. s.g. 820
„ Gallic	100·0	3·0	1·0	soluble in 4 parts
„ Oxalic	15·5	1·0	6·47	insoluble
„ Pyrogallic	2 25	...	...	sol. in alc. and ether
„ Salicylic	87·2	v'ry sol	0·35	easily soluble
„ Succinic..................	5 0	2·2	20·0	soluble in 3 parts
„ Tannic.....................	0·8	·5	...	sol. in alc. and ether
„ Tartaric	·66	·5	150·0	soluble
Alum (Potash)	10·5	v'ry sol	9·52	insoluble
„ (Ammonia)..............	7·32	„	13·66	„
Amidol	4	2	...	
Ammonium, Bichromate ...	sol.	sol.	...	insoluble
„ Bromide.........	1·4	0·78	41·1	sol. in 32·3 parts
„ Carbonate.......	3·3	·833	33·0	insoluble
„ Chloride.........	2·7	1·00	37·02	sparingly soluble
„ Citrate	deliqu	escent	very sol	less sol. in alcohol
„ Fluoride.........	v'ry sol	v'ry sol	...	slightly soluble
„ Iodide............	very	s'luble	...	soluble
„ Nitrate	2·0	1·0	50·0	freely soluble
„ Nitrite	del.	dec.		
„ Oxalate	4·0	2·0	...	soluble
„ Salicylate	very	s'luble		
„ Succinate	„	„		
„ Sulphocyanide.	·4	v'ry sol	easily	sol. in water and alc.
Barium, Bromide	·96	·5	104·2	easily soluble
„ Chloride { Crystallised	2 18	1·5	46 0	very slightly soluble
Anhydrous..	2·862	...	34·1	
„ Iodide	0·48	0·35	208·3	very soluble
„ Nitrate....................	12·2	2 84	8·18	
„ Sulphate	insol.			
Bromine	33	dec.	very sol	
Cadmium, Bromide	easily	s'luble	...	soluble in 3·4
„ Chloride	0·71	0·67		
„ Iodide	1·08	0·75	92·6	1 in ·98 abs. alc.
Calcium, Bromide (Cryst.)...	0·97	...	102·56	easily soluble
„ Chloride	0·25	any qy	400·0	
„ Iodide	deliqu	escent		
Cobalt, Chloride	very	s'luble		sol. in alc. and ether
Copper, Acetate	14	5	...	14
„ Bromide (Cupric) ...	1	·75	...	„ „
„ Chloride „ ...	·75	·75	very sol	„ „
„ Nitrate	s'luble		...	very soluble
„ Sulphate...............	2·5	·5	40·0	insoluble

TABLE OF THE SOLUBILITIES, &c.—Continued.

	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling		
Eikonogen	40·0	v'ry sol	...	soluble
Gold, Perchloride	1	0·75	vy. so'.	soluble in ether
Iron, Chloride Anhyd.	2·0	...	...	sol. in 1 part alcohol
(Ferrous) Hydrated	0·68	...	50·0	easily soluble
,, Chloride (Ferric)	0·75	·5	147·0	very soluble
,, Oxalate ,,	insolu	ble, ex	cept in	excess of oxalic acid
,, Sulphate ,,	sol'ble		...	soluble
,, ,, (Ferrous)	1·3	·30	77·0	insoluble
Lead, Acetate	3·7	3·45	27·0	soluble in 12·5 parts
,, Nitrate	7·7	...	13·0	
Lithium, Bromide	0·66	0 5	149·8	soluble
,, Chloride	1·315	1	76·0	
,, Iodide	0·61	0·75	164·0	
Magnesium, Bromide	deliqu	escent	vy. sol.	very soluble
,, Chloride	1·857	...	53·8	
,, Iodide	1	0·75	vy. sol.	soluble 1 in 5
,, Sulphate	1·47	0·66	68·04	slightly soluble
Mercury, Chloride (Mercuric)	16·0	3·0	6·25	soluble in 2·35 parts
Metol	18	10		
Platinum, Bichloride	1	0·5	...	eas. sol. in al. & ether
Potassium, Bichromate	10·0	7	10·0	
,, Bromide	1·55	1	64·5	
,, Carbonate	0·9	0·5	111·0	
,, Chloride	3·03	2·0	33·0	slightly soluble
,, Chloroplatinite	5·9	3		
,, Citrate	0·6	0·3		
,, Cyanide	1	0·5	vy. sol.	insol. in pure alcohol
,, Ferrocyanide	3·0	1·0	33·3	insoluble
,, Ferridcyanide	2·54	1·22	39·37	very sparingly sol'ble
,, Hydrate	0·5	0·25	200·0	very soluble
,, Iodide	0·7	0·27	143·0	sol. in 40 pts. abs. alc.
,, Nitrate	3·5	0·4	28·57	insoluble
,, Nitrite	deliqu	and so	luble	
,, Oxalate (neutral)	3·0	2	33·3	slightly soluble
,, ,, (bin.)	40·0	...	2·5	insoluble
,, ,, (quad.)	20·17	....	4·95	insoluble
,, Permanganate	16·0	10	6·25	insoluble
,, Sulphocyanide	2	1	...	insoluble
Silver, Acetate	very	sli'htly	sol.	
,, Citrate	sol'ble	in war	m w'ter	
,, Fluoride	deliqu	escent		
,, Nitrate	1·0	0·5	100·0	sol. in 4 pts. boil. alc.
,, Nitrite	300 0	dissol. easily	0·33	insoluble

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

	One part is soluble in—parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling		
Silver, Oxalate	spar'ly sol.	soluble	...	insoluble
,, Sulphate	200·0	88·0	0·5	insoluble
Sodium, Acetate (Cryst.)	2·86	·66	35·0	
,, Biborate (Borax)	12·44	2·0	8·033	insoluble
,, Bromide	1·13	1·0	88·5	
,, Carbonate (Cryst.)	2·0	1·0	50·0	insoluble
,, ,, (Anhyd.)	3·85	2·07	25·93	insoluble
,, Chloride	2·77	2·77	36·0	sparingly soluble
,, Citrate	1·0	0·5	100·0	sparingly soluble
,, Hydrate	1·65	0·5	60·63	easily soluble
,, Hyposulphite (Thiosulphate)	1·5	0·5	vy. sol.	insoluble
,, Iodide	0·55	0·3	180·0	sparingly soluble
,, Nitrate	1·136	1·0	88·03	sol. in 37 parts alc.
,, Nitrite	deliquescent		vy. sol.	very soluble
,, Phosphate	4·0	2·0	25·0	
,, Succinate	very soluble			
,, Sulphate	2·08	0·41	48·0	soluble
,, Sulphite	4·0	2·0	25·0	slightly soluble
,, Bisulphite	very soluble		...	insoluble
,, Sulphocyanide				
,, Tartrate	1·75	...	56·37	insoluble
,, Tungstate	4·0	2·0	25·0	
Strontium, Bromide	1·01	...	99·0	sparingly soluble
,, Chloride	1·88	...	53·0	feebly soluble
,, Iodide	0·56	0·27	178·5	
Uranium, Bromide (Hydrated)	1	0·5	...	soluble
,, Nitrate	0·5	0·25	200·0	sol. in alc. and ether
,, Oxalate	nearly insol.	30·0	...	insoluble
Zinc, Bromide	deliquescent		vy. sol.	very soluble
,, Chloride	0·333	...	300·0	very soluble
,, Iodide	vy. deliques. & sol.			very soluble

Percentage of Real Ammonia in Solutions of different Densities at 14° Centigrade.—CARIUS.

Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9593	10·0	0·9959	1·0

THERMOMETRIC TABLES.

SHOWING THE ASSIMILATION OF THE THERMOMETERS IN USE THROUGHOUT THE WORLD.

Celsius.	Réaumur.	Fahrenheit.	Celsius.	Réaumur.	Fahrenheit.
100	80·0	212·0	49	39·2	120·2
99	79·2	210·0	48	38·4	118·4
98	78·4	208·4	47	37·6	116·6
97	77·6	203·6	46	36·8	114·8
96	76·8	204·8	45	36·0	113·0
95	76·0	203·0	44	35·2	111·2
94	75·2	201·2	43	34·8	109·4
93	74·4	199·4	42	33·6	107·6
92	73·6	197·6	41	32·8	105·8
91	72·8	195·8	40	32·0	104·0
90	72·0	194·0	39	31·2	102·2
89	71·2	192·2	38	30·4	100·4
88	70·4	190·4	37	29·6	98·6
87	69·6	188·6	36	28·8	96·8
86	68·8	186·8	35	28·0	95·0
85	68·0	185·0	34	27·2	93·2
84	67·2	183·2	33	26·4	91·4
83	66·4	181·4	32	25·6	89·6
82	65·6	179·6	31	24·8	87·8
81	64·8	177·8	30	24·0	86·0
80	64·0	176·0	29	23·2	84·2
79	63·2	174·2	28	22·4	82·4
78	62·4	172·4	27	21·6	80·6
77	61·6	170·6	26	20·8	78·8
76	60·8	168·8	25	20·0	77·0
75	60·0	167·0	24	19·2	75·2
74	59·2	165·2	23	18·4	73·4
73	58·4	163·4	22	17·6	71·6
72	57·6	161·6	21	16·8	69·8
71	56·8	159·8	20	16·0	68·0
70	56·0	158·0	19	15·2	66·2
69	55·2	156·2	18	14·4	64·4
68	54·4	154·4	17	13·6	62·6
67	53·6	152·6	16	12·8	60·8
66	52·8	150·8	15	12·0	59·0
65	52·0	149·0	14	11·2	57·2
64	51·2	147·2	13	10·4	55·4
63	50·4	145·4	12	9·6	53·6
62	49·6	143·6	11	8·8	51·8
61	48·8	141·8	10	8·0	50·0
60	48·0	140·0	9	7·2	48·2
59	47·2	138·2	8	6·4	46·4
58	46·4	136·4	7	5·6	44·6
57	45·6	134·6	6	4·8	42·8
56	44·8	132·8	5	4·0	41·0
55	44·0	131·0	4	3·2	39·2
54	43·2	129·2	3	2·4	37·4
53	42·4	127·4	2	1·6	36·5
52	41·6	125·6	1	0·8	33·8
51	40·8	123·8	0	0·0	32·0
50	40·0	122·0			

THERMOMETRIC RULES.

The following rules for the rapid conversion of degrees in one system into another will be found useful :—

To Convert Centigrade into Reaumur :

Degrees Réaumur × 4 ÷ 5.
Ex.—80° R × 4 ÷ 5 = 64° C.

To Convert Centigrade into Fahrenheit :

Degrees Centigrade (× 9 ÷ 5) + 32.
Ex.—80° C. × 9 ÷ 5 = 144 + 32 = 176° F.

To Convert Reaumur into Centigrade :

Degrees Reaumur × 5 ÷ 4.
Ex.—60° R. × 5 ÷ 4 = 75° C.

To Convert Fahrenheit into Centigrade :

(Degrees Fahr.—32) × 5 ÷ 9.
Ex.—100° F. − 32 = 78 × 5 ÷ 9 = 43·3° C.

To Convert Reaumur into Fahrenheit :

Degrees Reaumur (× 9 ÷ 4) + 32.
Ex.—16° R. × 9 ÷ 4 = 36 + 32 = 68° F.

To Convert Fahrenheit into Reaumur :

(Degrees Fahrenheit—32) ÷ 9 × 4.
Ex.—95° F. − 32 = 63 ÷ 9 × 4 = 28° R.

TABLE OF THE WAVE-LENGTHS OF THE PRINCIPAL FRAUENHOFER SPECTRUM LINES AND THE ELEMENTS THAT GIVE THEM.

Colour.	Wave-Lengths in μμ.	Element.	Colour.	Wave-Lengths in μμ.	Element.
Infra red	Y 899·04		Ultra-violet	K 393·386	Ca
	898·65			L 382·056	Fe
	X^{IV} 880·61			M 372·778	Fe
	X^{III} 866·14			372·713	Fe
	X^{II} 854·18			N 358·132	Fe
	X^{I} 849·70			O 344·107	Fe
	Z 822·64			344·069	Fe
Red	A 759·397			P 336·130	Ca
	B 686·738	O (?)		Q 328·687	Fe
Orange	C 656·296	H		R 318·030	Fe
Yellow	D^1 589·608	Na		S 310·077	Fe
	D^2 589·013	Na		310 038	Fe
Green	E 527·043	Fe		310·004	Fe
	526·965	Fe		T 302·115	Fe
	b^1 518·373	Mg		302·070	Fe
Cyanine blue	F 486·143	H		U 294·800	Fe
Indigo	G 430·796	Fe		294·777	Fe
Violet	h 410·184	H			
	H 396·861	Ca			

RELATIVE EXPOSURES FOR VARYING PROPORTIONS OF IMAGE TO THE ORIGINAL.

[The following paper was read before the Royal Photographic Society by Mr. W. E. Debenham. Its usefulness would be diminished by abbreviation, hence we reproduce it in full.—Ed.]

WHEN an enlarged photograph has to be made, either from a negative or print, it is commonly understood that the greater the degree of enlargement the longer will be the exposure required, but I have generally found only the vaguest ideas to exist as to the amount by which such exposure has to be prolonged. Sometimes, indeed, it is assumed that the exposure will be in direct inverse proportion to the area covered, so that a copy of twice the linear dimensions of the original—covering, as it does, the area of four times the size—would require an exposure of four times that sufficing for a copy of the same size. This calculation, however, omits to recognise an important factor, and leads to serious error, the actual exposure required in the case mentioned (assuming the same lens and stop to be used) being not four times, but two and a quarter times, that of a copy of same size; whilst, when we come to high degrees of enlargement, the error would amount to an indication of nearly four times the exposure actually required.

To find the relative exposure, add one to the number of times that the length of the original is contained in the length of the image, and square the sum. This will give the figure found in the third column of the annexed table.

As examples: suppose a copy is wanted having twice the linear dimensions of the original. Take the number 2, add 1 to it, and square the sum, $3^2=9$. Again, if a copy is to be of eight times the linear dimensions of the original, take the number 8, add 1, and square the sum, $9^2=81$. Copies repectively twice and eight times the size (linear) of the original will thus require relative exposures of 9 and 81—*i.e.*, the latter will require nine times the exposure of the former.

It is convenient to have a practical standard for unity. An image of the same size as the original is a familiar case, and serves as such standard. By dividing the figures in the third column by four, we get at the figures in the last column, which represent the exposure required for varying degrees of enlargement or reduction, compared with the exposure for a copy of the same size.

The table is carried up to enlargements of thirty diameters; that is about the amount required for enlarging a *carte-de-visite* to life size.

The exposures required in reductions do not vary at all to the same extent that they do in enlargements. It has, therefore, not been thought necessary to fill in the steps between images of $\frac{1}{10}$ and $\frac{1}{20}$, and between $\frac{1}{20}$ and $\frac{1}{30}$ of the size of the original. Beyond $\frac{1}{30}$ there is scarcely any preceptible difference in the exposure until disturbance comes in from another cause, a considerable distance of illuminated atmosphere (haze or fog) intervening.

The figures in the second column will also serve as a table for distances from the lens to the plate and to the original, all that is necessary being to multiply by the principal focus of the lens in use. In the case of enlargements the figures less than 2 must be multiplied to get the distance from the original to the lens, and the figures greater than 2 or the distance from lens to image. For reductions the figures less than 2, multiplied by the principal focus of the lens, yield the distance from lens to plate; and the figures higher than 2, similarly multiplied, give the distance of original from lens.

Proportion of image to original (linear).	Distance of image from lens* in terms of principal focus.	Proportionate exposures.	Exposures proportioned to that required for copying same size.
$\frac{1}{30}$	$1\frac{1}{30}$	1·07	·27
$\frac{1}{20}$	$1\frac{1}{20}$	1·10	·28
$\frac{1}{10}$	$1\frac{1}{10}$	1·21	·3
$\frac{1}{8}$	$1\frac{1}{8}$	1·27	·31
$\frac{1}{6}$	$1\frac{1}{6}$	1·36	·34
$\frac{1}{4}$	$1\frac{1}{4}$	1·56	·39
$\frac{1}{2}$	$1\frac{1}{2}$	2·25	·56
$\frac{3}{4}$	$1\frac{3}{4}$	3·06	·76
(Same size) 1	2	4	1
2	3	9	2·25
3	4	16	4
4	5	25	6·25
5	6	36	9
6	7	49	12·25
7	8	64	16
8	9	81	20·25
9	10	100	25
10	11	121	30·25
11	12	144	36
12	13	169	42·25
13	14	196	49
14	15	225	56·25
15	16	256	64
16	17	289	72·25
17	18	324	81
18	19	361	90·25
19	20	400	100
20	21	441	110·25
21	22	484	121
22	23	529	132·25
23	24	576	144
24	25	625	156·25
25	26	676	169
26	27	729	182·25
27	28	784	196
28	29	841	210·25
29	30	900	225
30	31	961	240·25

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* With a double lens it is usually sufficient to measure from the position of the diaphragm plate.

"UNIFORM SYSTEM" NUMBERS FOR STOPS FROM $\frac{f}{1}$ TO $\frac{f}{100}$.

In the following table Mr. S. A. Warburton has calculated the exposure necessary with every stop from $\frac{f}{1}$ to $\frac{f}{100}$ compared with the unit stop of the "uniform system" of the Royal Photographic Society of Great Britain. The figures which are underlined show in the first column what $\frac{f}{a}$ must be in order to increase the exposure in geometrical ratio from $\frac{f}{4}$, the intermediate numbers showing the uniform system number for any other aperture.

f	U. S. No.
1	1/16
1¼	·097
1·414	⅛
1½	·140
1¾	·191
2	¼
2¼	·316
2½	·390
2·828	½
2¾	·472
3	·562
3¼	·660
3½	·765
3¾	·878
4	1·00
4¼	1·12
4½	1·26
4¾	1·41
5	1·56
5¼	1·72
5½	1·89
5·656	2
5¾	2·06
6	2·25
6¼	2·44
6½	2·64
6¾	2·84
7	3·06
7¼	3·28
7½	3·51
7¾	3·75
8	4
8¼	4·25
8½	4·51
8¾	4·78
9	5·06
9¼	5·34
9½	5·64
9¾	5·94
10	6·25
11	7·56
11·31	8
12	9·00
13	10·56
14	12·25
15	14·06
16	16
17	18·06
18	20·25
19	22·56
20	25·00
21	27·56
22	30·25
22·62	32
23	33·06
24	36·00
25	39·06
26	42·25
27	45·56
28	49·00
29	52·56
30	56·25
31	60·06
32	64
33	68·06
34	72·25
35	76·56
36	81·00
37	85·56
38	90·25
39	95·06
40	100·00
41	105·06
42	110·25
43	115·56
44	121·00
45	126·56
45·25	128
46	132·25
47	138·06
48	144·00
49	150·06
50	156·25
51	162·56
52	169·00
53	175·56
54	182·25
55	189·06
56	196·00
57	203·06
58	210·25
59	217·56
60	225·00
61	232·56
62	240·25
63	248·06
64	256
65	264·06
66	272·25
67	280·56
68	289·00
69	297·56
70	306·25
71	315·06
72	324·00
73	333·06
74	342·25
75	351·56
76	361·00
77	370·56
78	380·25
79	390·06
80	400·00
81	410·06
82	420·25
83	430·56
84	440·00
85	451·56
86	462·25
87	473·06
88	484·00
89	495·06
90	506·25
90·50	512
91	517·56
92	529·00
93	540·56
94	552·25
95	564·06
96	576·00
97	588·06
98	600·25
99	612·56
100	625·00

CONTINENTAL STOPS AND THEIR U.S. EQUIVALENTS.

MR. EDWARD M. NELSON says: "Photographers are frequently troubled by the Continental nomenclature of the stops, and wish to know the U.S. equivalents for them. The method of finding this out is very simple. All that is necessary is to divide f-4 by the ratio to be converted, and square the result. Example: required the U.S. equivalent of f-9:—

$$\frac{f}{4} \div \frac{f}{9} = \frac{f}{4} \times \frac{9}{f} = 2{\cdot}25;$$

the square of 2·25 is 5·06, the U.S. number required. The following is a table of the Continental stops more commonly met with, and also the Continental values of the U.S. ratios:—

Ratios. f divided by	Continental Values.	U.S. Values.	Ratios. f divided by	U.S. Values.	Continental Values.
4·5	512	1·26	2·828	·5	1250
6·3	256	2·48	4	1	625
7	204	3·06	5·66	2	312
7·2	193	3·24	8	4	156
7·7	168	3·71	11·31	8	78
9	128	5·06	16	16	39
12·5	64	9·77	22·6	32	20
14·5	47	13	32	64	9·77
18	32	20	45·3	128	4·88
25	16	39	64	256	2·44
36	8	81	90·5	512	1·22
50	4	156	...	...	...
71	2	315	...	...	...
100	1	625	...	...	...

"To find the f ratio for the U.S. values, multiply the U.S. value by 16 and the square root of the product is the required ratio. Example: What is the ratio of U.S. 32? 32 multiplied by 16 is 512, the square root of this is 22·6, the ratio required.

"To find the f ratio for the Continental stops, multiply the reciprocal of the square root of the Continental value by 100. Example: What is the f ratio of the Continental value 16? The square root of 16 is 4, the reciprocal of 4 is ·25, which, multiplied by 100, is 25, the ratio required.

"*Note.*—The Continental ratios of 512, 256, and 8, ought to be 4·4, 6·25, and 35, respectively. The figures in the list are those extracted from Continental opticians' catalogues."

STANDARDS OF THE ROYAL PHOTOGRAPHIC SOCIETY.

THE series of standards adopted by the Society in 1881, and modified in 1891, have been again carefully reconsidered by a committee of experts appointed by the Council. Their recommendations, which are embodied below, have been adopted by the Council, by whose orders this schedule is now published.

LENS DIAPHRAGMS.

(1) That intensity ratio be defined as dependent upon the *effective aperture*, and not upon the diameter of the diaphragm, in relation to the focal length of the lens.

(2) That effective aperture be determined in the following manner: The lens shall be focussed for parallel rays; an opaque screen shall be placed in the principal focal plane, the plate being provided in its centre (in the axis of the lens) with a pin-hole; an illuminant shall be placed immediately behind the pin-hole, and the diameter of the beam of light emerging from the front surface of the lens shall be the measure of the effective aperture.

NOTE.—It will be found, except when the diaphragm is situated in front of the lens, that the diameter of the diaphragm itself is seldom identical with the effective aperture.

(3) That every diaphragm be marked with its true intensity ratio, as above defined, in the following order of sequence; *f*-1, *f*-1·4.., *f*-2, *f*-2·8.., *f*-4, *f*-5·6.., *f*-8, *f*-11·3.., *f*-16, *f*-22·6.., *f*-32, *f*-45·2.., *f*-64, &c., each diaphragm requiring double the exposure required by the preceding diaphragm.

Should the greatest effective aperture of a lens not conform exactly to one of the intensities set forth above, this aperture should be marked in accordance with the definition of effective aperture, but all succeeding smaller apertures should be marked in uniformity with the intensities recommended in the above sequence.

LENS MOUNTS AND FITTINGS.

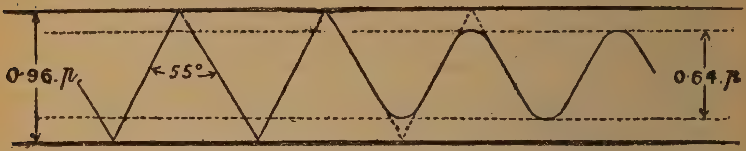
(1) That the equivalent focal length of a lens be engraved upon its mount.

(2) That the following series of screws for photographic lens flange fittings be adopted, it being understood that, in order to secure free interchangeability, every male screw should be made at least as small as these sizes, and every female screw at least as large:—

Diameter in Inches.	No. of Threads per Inch.	Core Diameter in Inches.
1*	24	·9466
1·25	24	1·1966
1.5	24	1·4466
1·75	24	1·6966
2	24	1·9466
2·25	24	2·1966
2·5	24	2·4466
3	24	2 9466
3·5	12	3·3933
4	12	3·8933
5	12	4·8933
And upwards, advancing by inches.	12	

* For screws less than one inch in diameter, the Royal Microscopical Society's tandard screw should be adopted.

The form of thread is that known as Whitworth's Angular Thread, and is designed as follows:—



Two parallel lines, at a distance apart equal to 0·96 of the screw pitch, are intersected by lines inclined to each other at fifty-five degrees, is shown in the figure at A. One-sixth of the vertical height of the triangular spaces so obtained is rounded off both at the top and bottom. leaving the form of the screw thread as at B. The depth of this thread is 0·64 of the screw pitch. It should be understood that this is the theoretical form of the Whitworth thread, but that for the purpose of securing real interchangeability it is generally found necessary to use chasers or other threading tools which have additional prominence upon their points which come first into operation and are subject to most wear. For this purpose an addition may be made to the amount of one-tenth ($\frac{1}{10}$) of the theoretical depth of thread, or to any less amount that may be sufficient.

(3) That every flange and adapter have a mark upon its front to indicate the position of the diaphragm slot or index of any lens when screwed home. The mark on any adapter should coincide with the mark upon any flange into which it is screwed. This mark should be placed at the point at which the thread becomes complete at the shoulder of the flange or adapter.

CAMERA SCREWS.

That all screws fitted to cameras, either for attachment to the stand, for fixing rising fronts, or for other movable parts, be either $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, or $\frac{3}{8}$ of an inch in external diameter, and in pitch of thread and other details in accordance with the generally recognised Whitworth standards for these sizes.

TABLE FOR ENLARGEMENTS.

Focus of Lens, inches.	TIMES OF ENLARGEMENT AND REDUCTION.							
	1 inches.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
2	4 4	6 3	8 2 2/3	10 2 1/2	12 2 2/5	14 2 1/3	16 2 2/7	18 2 1/4
2 1/2	5 5	7 1/2 3 3/4	10 3 1/3	12 1/2 3 1/8	15 3	17 1/2 2 11/12	20 2 6/7	22 1/2 2 13/16
3	6 6	9 4 1/2	12 4	15 3 3/4	18 3 3/5	21 3 1/2	24 3 3/7	27 3 3/8
3 1/2	7 7	10 1/2 5 1/4	14 4 2/3	17 1/2 4 3/8	21 4 1/5	24 1/2 4 1/12	28 4	31 1/2 3 15/16
4	8 8	12 6	16 5 1/3	20 5	24 4 4/5	28 4 2/3	32 4 4/7	36 4 1/2
4 1/2	9 9	13 1/2 6 3/4	18 6	22 1/2 5 5/8	27 5 2/5	31 1/2 5 1/4	36 5 1/7	40 1/2 5 1/16
5	10 10	15 7 1/2	20 6 2/3	25 6 1/4	30 6	35 5 5/6	40 5 5/7	45 5 5/8
5 1/2	11 11	16 1/2 8 1/4	22 7 1/3	27 1/2 6 7/8	33 6 3/5	38 1/2 6 5/12	44 6 2/7	49 1/2 6 3/16
6	12 12	18 9	24 8	30 7 1/2	86 7 1/5	42 7	48 6 6/7	54 6 3/4
7	14 14	21 10 1/2	28 9 1/3	35 8 3/4	42 8 2/5	49 8 1/6	56 8	63 7 7/8
8	16 16	24 12	32 10 2/3	40 10	48 9 3/5	56 9 1/3	64 9 1/7	72 9
9	18 18	27 13 1/2	36 12	45 11 1/4	54 10 4/5	63 10 1/2	72 10 2/7	81 10 1/8

THE object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration:—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

If the focus of the lens be twelve inches, as this number is not in the column of focal lengths, look out for six in this column and multiply by 12, and so on with any other numbers

TABLE OF VIEW-ANGLES.

By Clarence E. Woodman, Ph.D.

Divide the Base of the Plate by the Equivalent Focus of the Lens.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
·282	16	·748	41	1·3	66
·3	17	·768	42	1·32	67
·317	18	·788	43	1·36	68
·335	19	·808	44	1·375	69
·353	20	·828	45	1·4	70
·37	21	·849	46	1·427	71
·389	22	·87	47	1·45	72
·407	23	·89	48	1·48	73
·425	24	·911	49	1·5	74
·443	25	·933	50	1·53	75
·462	26	·954	51	1·56	76
·48	27	·975	52	1·59	77
·5	28	1·	53	1·62	73
·517	29	1·02	54	1·649	79
·536	30	1·041	55	1·678	80
·555	31	1·063	56	1·7	81
·573	32	1·086	57	1·739	82
·592	33	1·108	58	1·769	83
·611	34	1·132	59	1·8	84
·631	35	1·155	60	1·833	85
·65	36	1·178	61	1·865	86
·67	37	1·2	62	1·898	87
·689	38	1·225	63	1·931	88
·708	39	1·25	64	1·965	89
·728	40	1·274	65	2·	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plates respectively $3\frac{1}{4} \times 4\frac{1}{4}$, $4\frac{1}{4} \times 6\frac{1}{2}$, $6\frac{1}{2} \times 8\frac{1}{2}$, 8 × 10, 10 × 12, and 11 × 14.

1. Dividing 4·25 by 13, we have as quotient ·327—midway between the decimals ·317 and ·335 of our table; therefore the required angle is 18° 30′. Similarly—

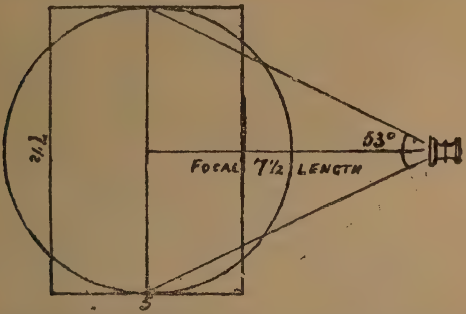
						Degrees.
2.	6·5	÷	13	=	·5;	corresponding to 28.
3.	8·5	÷	13	=	·654;	„ „ 36.
4.	10	÷	13	=	·77;	„ „ $42\frac{1}{2}$.
5.	12	÷	13	=	·923;	„ „ $49\frac{1}{2}$.
6.	14	÷	13	=	1·08;	„ „ 57.

VIEW-ANGLES.

THE late Mr. M. J. Michael wrote us as follows:—

'I take this opportunity of drawing your attention to the "Table of View-angles," in THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC. If used as there directed, it leads to results inaccurate and misleading; inaccurate, since the angle included on a plate should be measured along the diagonal and not along the base of the plate; and the information is misleading, since it leads to the supposition that a lens having the angle which is given by using the table, as there directed, will cover the plate mentioned. Hence all the examples given at the foot of the table specify lenses that, if used on the given plates, must leave at least two, and if the lens is placed centrally, all the four, corners uncovered. If the corners of a plate are to be covered, the angle embraced by the lens must be sufficient to cover the diagonal of the plate; in other words, the circle of illumination given by the lens must have a diameter equal to the diagonal of the plate, and not only equal to the length of the base of the plate.

'A simple figure makes this evident. If the focal length of the lens, *e.g.*, seven and a half inches on a 7½ × 5 plate, is equal to the base of the plate, then, using the table as is directed, the quotient obtained is 1 and the angle 53°. From the figure, which is to scale, it is evident that arrange the plate as you will, at least two, and if placed centrally, all four corners must be uncovered, *i.e.*, outside the circle of illumination.



'The table itself is correct when used as is usually directed by dividing the diagonal of any given plate by the focal length of the lens (see Dr. Eder, *Recepte und Tabellen*, fourth edition, page 94). If, therefore, the directions for using it were altered by substituting "diagonal of the plate" for the words "base of the plate," the results obtained would be correct. It would save trouble if beneath the table were printed the length of the diagonals of the plates most commonly used:—

3¼ × 3¼	diagona	4·6 inches.	6½ × 8½	diagonal	10·7 inches
3¼ × 4¼	„	5·3 „	8 × 10	„	12·4 „
4 × 5	„	6·4 „	10 × 12	„	15·6 „
4¾ × 6½	„	8· „	12 × 15		19 4 „
× 7					

EQUATIONS RELATING TO FOCI, &c.

THE following simple optical formulæ and calculations, worked out by Mr. J. A. C. Branfill, will prove useful in many branches of photography, especially where several lenses of varying foci are in constant use for a variety of purposes:—

Let p = Principal focus.
F = Greater conjugate do.
f = Lesser do. do.
$D = F + f$ = distance of image from object.
r = Ratio of any dimension in original to the same dimension in copy (in case of reduction), or *vice versâ* (in case of enlargement).
a = Effective diameter of diaphragm.
U. S. No. = 'Uniform System' No. of do.
x = Comparative exposure required.

Then

$$p = D \times \frac{r}{(r+1)^2} = \frac{Ff}{D} = \frac{F}{r+1} = \frac{rf}{r+1}$$

$$F = p(r+1) = \frac{pf}{f-p} = rf = \frac{rD}{r+1}$$

$$f = p \times \frac{(r+1)}{r} \quad \frac{p}{F-p} = \frac{D}{r+1} = \frac{F}{r}$$

$$D = p \times \frac{(r+1)^2}{r} = f(r+1) = p\left(2 + r + \frac{1}{r}\right)$$

$$r = \frac{F-p}{p} = \frac{p}{f-p} = \frac{F}{f}$$

$$\text{U. S. No.} = \frac{p^2}{16\,a^2}$$

$$x = \frac{f^2}{16\,a^2} = \frac{p^2}{16\,a^2} \times \frac{(r+1)^2}{r^2}$$

N.B.—For ordinary landscape work, where r is greater than 20, x may be taken as $\frac{p^2}{16\,a^2}$

NOTE.—In case the above may not be clear to some photographers, the following rules may be better understood:—

To find the principal focus of a lens (p), focus a near object in the camera, and measure the distance between it and the ground-glass (D); next find the proportion which any dimension in the object bears to the same dimension on the ground-glass (r). Thus, if the original dimension be four times as large as its reproduction, we say that r equals (=) 4. Multiply D by r, and divide the product by the square of a number greater by one than r, or $(r+1)$. This rule was lately published by Mr. Debenham.

To find the lesser conjugate focus (f) (if p and r are known) multiply p by the sum of $r+1$, and divide the product by r. Or divide D by $r+1$.

To find the greater conjugate focus (F) multiply p by $r+1$. Or multiply f by r.

To find D (the distance which the ground-glass should be from the object to be copied in order to get a given value for r) multiply p by the sum of $r + \frac{1}{r} + 2$.

To find r divide $F-p$ (the difference between F and p) by p. Or divide p by $f-p$. Or divide F by f.

To find x divide the square of f by 16 times the square of a (the diameter of aperture to lens).

For example: focus an object which is five inches high, so that it is one inch high on the ground glass; thus we know that $r = 5$. Next measure the distance between the object and the ground glass (D), which is found to be 45 inches.

Then $p = 45 \times$ (multiplied by) $5 \div$ (divided by) $6 \times 6 = 6\frac{1}{4}$ inches.
$f = 6\frac{1}{4} \times 6 \div 5 = 7\frac{1}{2}$ inches. Or $f = 45 \div 6 = 7\frac{1}{2}$ inches.
$F = 6\frac{1}{4} \times 6 = 37\frac{1}{2}$ inches. Or $F = 7\frac{1}{2} \times 5 = 37\frac{1}{2}$ inches.
$D = 6\frac{1}{4} \times (5 + \frac{1}{5} + 2) = 6\frac{1}{4} \times 7\frac{1}{5} = 45$ inches.
$r = (37\frac{1}{2} - 6\frac{1}{4}) \div 6\frac{1}{4} = 5$. Or $r = 6\frac{1}{4} \div (7\frac{1}{2} - 6\frac{1}{4}) = 5$.

MR. E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

Distance of Projection Lens from Screen, Mask being Three Inches.

Foci	4½	5	5½	6	7	8	9	10	11	12	14	15	16	18
Disc.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.		ft. in.	ft. in.	ft. in.	ft. in.
5	7 10½	8 9	9 7½	10 6	12 3	14 0	15 9	17 6	19 3	21	24 6	26 3	28 0	31 6
6	9 4½	10 5	11 5½	12 6	14 7	16 8	18 9	20 10	22 11	25	29 2	31 3	33 4	37 6
7	10 10½	12 1	13 3½	14 6	16 11	19 4	21 9	24 2	26 7	29	33 10	36 3	38 8	43 6
8	12 4½	13 9	15 1½	16 6	19 3	22 0	24 9	27 6	30 3	33	38 6	41 3	44 0	49 6
9	13 10½	15 5	16 11½	18 6	21 7	24 8	27 9	30 10	33 11	37	43 2	46 3	49 4	55 6
10	15 4½	17 1	18 9½	20 6	23 11	27 4	30 9	34 2	37 7	41	47 10	51 3	54 8	61 6
11	16 10½	18 9	20 7½	22 6	26 3	30 0	33 9	37 6	41 3	45	52 6	56 3	60 0	67 6
12	18 4½	20 5	22 5½	24 6	28 7	32 8	36 9	40 10	44 11	49	57 2	61 3	65 4	73 6
13	19 10½	22 1	24 3½	26 6	30 11	35 4	39 9	44 2	48 7	53	61 10	66 3	70 8	79 6
14	21 4½	23 9	26 1½	28 6	33 3	38 0	42 9	47 6	52 3	57	66 6	71 3	76 0	85 6
15	22 10½	25 5	27 11½	30 6	35 7	40 8	45 9	50 10	55 11	61	71 2	76 3	81 4	91 6
16	24 4½	27 1	29 9½	32 6	37 11	43 4	48 9	54 2	59 7	65	75 10	81 3	86 8	97 6
18	27 4½	30 5	33 5½	36 6	42 7	48 8	54 9	60 10	66 11	73	85 2	91 3	97 4	109 6
20	30 4½	33 9	37 1½	40 6	47 3	54 0	60 9	67 6	74 3	81	94 6	101 3	108 0	121 6
25	37 10½	42 1	46 3½	50 6	58 11	67 4	75 9	84 2	92 7	101	117 10	126 3	134 8	151 6
30	45 4½	50 5	55 5½	60 6	70 7	80 8	90 9	100 10	110 11	121	141 2	151 3	161 4	181 6
35	52 10½	58 9	64 7½	70 6	82 3	94 0	105 0	117 6	129 3	141	164 6	176 3	188 0	211 6
40	60 4½	67 1	73 9½	80 6	93 11	107 4	120 9	134 2	147 7	161	187 10	201 3	214 8	241 6
45	67 10½	75 5	82 11½	90 6	105 7	120 8	135 9	150 10	165 11	181	211 2	226 3	241 4	271 6
50	75 4½	83 9	92 1½	100 6	117 3	134 0	150 9	167 6	184 3	201	234 6	251 3	268 0	301

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

EQUIVA-LENT FOCUS (INCHES).	HEIGHTS OF IMAGES (INCHES).																
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47·3 2·1	36·0 2·1													
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3												
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5											
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7										
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2								
7	483·0 7·0	245·0 7·1	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6							
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4						
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6						
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1				
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2			
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6			
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6		

Values are omitted in this space on account of the wide angle of lens required.
(More than ninety degrees.)

14	996·0 14·2	490·0 14·4	331·3 14·6	252·0 15·7	172·7 14·8	133·0 15·6	109·2 16·1	93·3 16·5	82·0 16·9	73·5 17·3	61·6 18·0	53·7 18·9	19·8	43·7 20·6	37·8 22·2			
16	1104 16·2	560·0 16·5	378·7 16·7	288·0 16·9	197·3 17·4	152·0 17·9	124·8 18·4	106·7 18·8	93·7 19·3	84·0 19·8	70·4 20·7	61·3 21·6	54·9 22·6	50·0 23·5	43·2 25·4	38·7 27·3	35·4 29·2	
18	1242 18·3	630·0 18·5	426·0 18·8	324·0 19·1	222·0 19·6	171·0 20·1	140·4 20·6	120·0 21·2	105·4 21·7	94·5 22·2	79·2 23·3	69·0 24·4	61·7 25·4	56·2 26·5	48·6 28·6	43·5 30·7	39·9 32·8	36·0 36·0
20	1380 20·3	700·0 20·6	473·3 20·9	360·0 21·2	246·7 21·8	199·0 22·4	156·0 22·9	133·3 23·5	117·1 24·1	105·0 24·7	88·0 25·9	76·7 27·1	68·6 28·2	62·5 29·4	54·0 31·8	48·3 34·1	44·3 36·5	40·0 40·0
22	1518 22·3	770·0 22·6	520·7 23·0	396·0 23·3	271·3 23·9	209·0 24·6	171·6 25·2	146·7 25·9	128·9 26·5	115·5 27·2	96·8 28·5	84·3 29·8	75·4 31·1	68·7 32·4	59·4 35·9	53·2 37·6	48·7 40·1	44·0 44·0
24	1656 24·4	840·0 24·7	568·0 25·1	432·0 25·4	296·0 26·1	228·0 26·8	187·2 27·5	160·0 28·2	140·6 28·9	126·0 29·6	105·6 31·1	92·0 32·5	82·3 33·9	75·0 35·3	64·8 38·1	58·0 40·9	53·1 43·8	48·0 48·0
26	1794 26·4	910·0 26·8	615·3 27·1	468·0 27·5	320·6 28·3	247·0 29·0	202·8 29·8	173·3 30·6	152·3 31·3	136·5 32·1	114·4 33·6	99·7 35·2	89·1 36·7	81·2 38·2	70·2 41·3	62·8 44·4	57·6 47·4	52·0 52·0
28	1932 28·4	980·0 28·8	662·7 29·2	504·0 29·6	345·3 30·5	266·0 31·3	218·4 32·1	186·7 32·9	164·0 33·8	147·0 34·6	123·2 36·2	107·3 37·9	96·0 39·5	87·5 41·2	75·6 44·5	67·7 47·8	62·0 51·1	56·0 56·0
32	2208 32·5	1120 32·9	757·3 33·4	576·0 33·9	394·7 34·8	304·0 35·8	249·6 36·7	213·3 37·6	187·4 38·6	168·0 39·5	140·8 41·4	122·7 43·3	109·7 45·2	100·0 47·1	86·4 50·8	7·3 54·6	70·9 58·4	64·0 64·0
36	2484 36·5	1260 37·1	852·0 37·6	648·0 38·1	444·0 39·2	342·0 40·2	280·8 41·3	240·0 42·4	210·9 43·4	189·0 44·5	158·4 46·6	138·0 48·7	123·4 50·8	112·5 52·9	97· 57·2	87·0 61·4	79·7 65·6	72·0 72·0
44	3036 44·6	1540 45·3	1041 45·9	792·0 46·7	542·7 47·9	418·0 49·2	343·2 50·5	293·3 51·8	257·7 53·1	231·0 54·3	193·6 56·9	168·7 59·6	150·9 62·1	137·5 64·7	118·8 69·9	106·3 75·1	97·4 80·2	88·0 88·0
52	3588 52·8	1820 53·5	1231 54·3	936·0 55·1	641·3 56·6	494·0 58·1	405·6 59·6	346·7 61·2	304·6 62·7	273·0 64·2	228·8 67·3	199·3 70·4	178·3 73·4	162·5 76·5	140·4 82·6	125·7 88·7	115·1 94·8	104·0 104·0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distant from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15·6 inches.

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS.

SIR D. SALOMON'S TABLE.

Focus of Lens in inches.	Ratios marked on Stops.													
	f/7	*f*/8	*f*/9	*f*/10	*f*/11	*f*/12	*f*/13	*f*/14	*f*/15	*f*/16	*f*/17	*f*/18	*f*/19	*f*/20
	Number of feet after which all is in focus.													
4	19	17	15	14	13	12	11	10	9	9	8	8	7	7
4¼	21	19	17	15	14	12	11	11	10	10	9	9	8	7
4½	25	22	19	17	16	15	13	13	12	11	10	10	9	9
4¾	27	23	21	19	18	16	15	14	13	12	12	11	10	10
5	30	27	24	21	19	18	17	15	14	14	13	12	11	10
5¼	33	29	25	23	21	20	18	17	16	15	14	13	13	12
5½	37	31	29	26	23	22	20	19	17	16	15	15	14	13
5¾	39	34	31	28	26	24	22	20	18	18	17	16	15	14
6	43	38	33	31	28	26	24	22	21	20	18	17	16	15
6¼	47	41	37	33	30	28	26	24	22	20	20	19	18	17
6½	50	45	40	36	33	29	28	26	24	23	21	20	19	18
6¾	55	48	43	39	36	32	30	28	25	24	22	22	21	20
7	58	52	45	42	38	35	31	30	28	26	25	23	22	21

DR. J. J. HIGGINS'S TABLE.

Equivalent Focus.	*f*/5	*f*/6	*f*/7	*f*/8	*f*/	*f*/10	*f*/11	*f*/12	*f*/13	*f*/14	*f*/15
5 inches	42	35	30	26	23	21	19	17½	16	15	14
5½ ,,	50½	42	36	32	28	25	23	21	19	18	17
6 ,,	60	50	43	38	34	30	27	25	23	21	20
6½ ,,	70½	59	50	44	39	35	32	29½	27	25	23½
7 ,,	82	68	59	51	45	41	39	34	31	29½	27

Calculated for a Confusion Disc of less than $\frac{1}{100}$ of an inch.

⁂ *Extra* 16 *pages in Advertisements, folios* 1559A *to* 1574A, *accounts for the omission of* 16 *pages here.*

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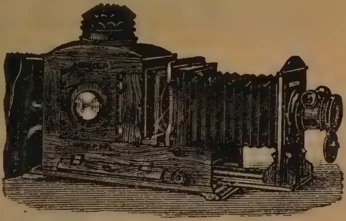

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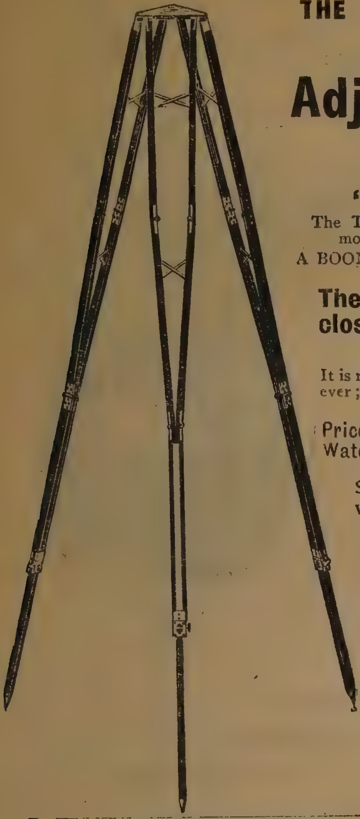

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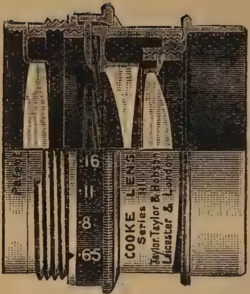

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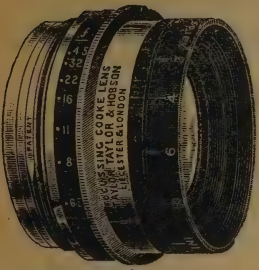

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